THE

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THE STRIKE TROUBLE.

BREACH of faith, contempt for the very laws they have forced on the community, pillage, arson, and, at Liverpool, even homicide; such is a brief catalogue of the week's misdemeanours of men who, without reason, have elected to strike at the expense of the whole community. There is a very fever of striking in the hot summer air. Indeed, it is arguable on many grounds that this semi-insanity has its origin in the physiological effects of that long-continued heat and brilliant sunshine which students of the different races of mankind tell us are not the climatic conditions in which the Aryan people have attained their best development. A few days of downpour would probably be the best thing we could hope for.

It appears to have occurred to the promoters of the strikes that transport of goods and of food offered the best field for their destructive energies, and so they set themselves to place London and other places in a state of siege. We may take it that the men who are striking are a small minority of the community more or less reinforced by every blackguard hooligan who never has, nor never will, try to do a good day's work. The method of procedure is first to cease work in defiance of all obligation. Men under the Conciliation Act who have been glad to seize the benefits of an arbitration when it has gone their way are literally cursing this very Act which they forced, on the railways more particularly, four years ago, and since the Government persuaded the employers to accept this Act, and so *loose* control of their own business to that extent, the Government are bound to see to it that the other parties adhere to its provisions. But what do we see?

Carts and vans overturned, and their drivers intimidated by that travesty of words "peaceful picketing." Such a thing never did exist, does not exist now, and never can exist, for were picketing ever to become peaceful, it would imply an intelligence that would scorn to use such a weapon.

Do the men realise their own case? They strike against the community. If unsuccessful, they fall back on the poor law to support them and their families. Suppose the community struck, and withheld their poor rates and rose *en masse* against the Guardians, where then would be the strikers?

There is a proper and peaceful way of putting forward requests for improvement. But these strikers go out without recourse to the very machinery organised for their benefit. Most of them are in receipt of regular employment. Their pay may be small, though we do not believe it is so little as that of many men in less certain work, and it is much more than that of many—perhaps most—casual labourers. Yet we find some of the strikers crying out that they are paid less than the dockers' 8d. But the docker is casual; he works like a Trojan on a particular job, draws £3 in a comparatively short time, and then, perhaps, stands

off as long or twice as long, waiting for the next job, yet compelled to be on the watch for it.

The L.C.C. tramway men are threatening to strike, and they make a very unreasonable demand, for they ask special pay on public holidays. Tramway work is special work. Men are only too glad to get into it. They know what it is they are undertaking. Every L.C.C. employé knows that public holidays are busy tramway days. If a carpenter asks for extra pay on a public holiday, it is a reasonable asking, for he is a member of the public. But a policeman who starts to grumble on account of night work, or a sailor who would not pull a rope on Sunday, would be on a par with a tramway man who asks special pay on public holidays. The police, the tramway men, railway men, postmen, and all the similar classes of labour, are not strictly to be regarded as members of the public. They are, by choice, the servants of the public, and they all have certain advantages which more than make up for their various hardships. The real public, who pay these men, must be the final arbiters, for some of these malcontents are better off than very many of the ratepayers.

If a man is dissatisfied with his position, he has perfect freedom of action, and may give in his notice, draw his final week's pay and seek other and more congenial work. But he elects to punish his employers, who can really do without the tramways at a pinch, as they did without them until quite lately. We dwell on the tramway threat because tramways, both in London and elsewhere, are a portion of the electrical industry which has been so fastened upon and so hopelessly muddled by the municipal men of this country. There is no real discipline in municipal tramway working —perhaps we may except Glasgow. It is notorious that the employés of the L.C.C. tramways are regarded and regard themselves from the standpoint of voters. Every trivial matter must go to the Highways Committee. Of discipline in the ordinary business sense there is none, but let the Council stand firm for once and refuse to be coerced. We think the public would, for a while, put up with the walking if the cars were stopped.

But to return to the strikers' picketings.

As a body, the strikers belong to that class who raise the cry of "the right to work." But how do they act on the principle? By preventing others from working, by intimidation, van wrecking, and even by turning a harmless passenger and his baggage out of a cab.

This howling mob has been permitted to cripple London's food supply without let or hindrance. Thousands of tons of food have been destroyed, trade disorganised and the community put to severe loss because the Government, in a moment of great emergency, have refused to support law and order, and to enforce the terms called for by the very men who now refuse to be bound by them.

The sympathetic strike is also very much in evidence. Because Jones has a grievance and goes out, Smith must break his own employer's windows out of sympathy.

Smith who might far better help Jones out of his own wages, elects to idle with Jones in the ditch of pauperism. It seems silly to write of such things. They are incomprehensible, if not unbelievable. And so we see factories full of silly girls throwing up their work and parading the streets out of "sympathy," and on the top of it all, the men's leaders climbing to wealth and power, using the ignorance and summer madness of the men as a ladder on which to climb, as in 1897.

Yet the men who are striking are, all round, in steady work, and steady work at moderate pay is far better and more remunerative than casual labour. They are, as said above, in receipt of far better incomes than some of the ratepayers or taxpayers. Probably much of the trouble arises from sheer economic ignorance. It is a very common fallacy of belief that the Government, and the City and the town have a bottomless pocket of money, out of which it is possible to pay every man what he wants. All these authorities have power only to squeeze money out of taxpayers, and taxpayers are wanting to know why they should pay so much to men who are better off than themselves. Is it possible after so many years of compulsory education that ignorance of these matters prevails throughout the mass of what we might rightly term the privileged workers? Do they believe that by rioting, pillage and incendiarism they will enable the public the better able to bear the increased expense which the extravagant demands must entail on all of us if acceded to?

On Tuesday morning the Prime Minister and the President of the Board of Trade called into conference with them the Presidents of a number of important employers' associations, for an exchange of views concerning the present position of affairs, and to consider the possibility of improving the means available for preventing or shortening industrial wars. Sir Andrew Noble and Mr. Alexander Siemens were representatives of the engineering trades at this Conference. Mr. Siemens, it will be recalled, was a leading spirit in the Engineering Employers' Federation which successfully coped with the engineering strike of 1897. On the afternoon of the same day representatives of the principal trade unions were likewise called into conference with the same Ministers.

It is to be hoped that the pulse of industry and labour being thus hurriedly felt, may do something to give Ministers a better understanding of the position. We profoundly hope also that they will, by the whole series of very disastrous events, be brought to see that State interference with industry brings the most serious consequences to everybody.

The State has interfered of late in many ways entirely in the supposed interests of the labourer. Such interference has not been by any means an unmixed benefit for his class. Much of it has sapped the independence of the people. And in this matter we should like to see the people display real independence. Is it not hateful to read how workers in certain lines complain of the scarcity of tips? Is not this question of tips a disgrace? Are not tips and the potential of receiving tips inevitably considered in the wages paid? The public who read of the lowness of pay and the almost entire lack of tips, wonder what becomes of the tips they are parting with at every turn. It is all part of the loss of respect and independence of the people. Our pauperising Acts of Parliament are busy catering for a class. The so-called benefits of these Acts are withheld from the most needy. Their effects are visible in these abnormal and wicked strikes. A little early firmness would have checked the lawlessness. These strikers need to learn that "Freedom is the liberty of all men to do as they ought, not the liberty to do as they like." And public freedom, so grossly violated, must be reinstated at any cost. Force is no remedy, but it has been made a necessity, and should be rigidly employed, for the people of this country will not permit a small section of malcontents to tyrannise over them.

Do not let it be forgotten that when Mr. Lloyd George brought the railway companies to agree to the Conciliation Agreement in 1907, there was an understanding that this general striking such as was even then threatened, would be made illegal. It was, we believe, distinctly suggested that arbitration would be made compulsory. And so the Conciliation Boards were established, and yet the men walk out of work in a body, and even in some instances say when doing so, that they have no grievances.

The Midland men and the North-Western men in Liverpool go out with *expressed regret*. They say they are satisfied. But though there are so many of them, they allow themselves to be terrorised. One would think they would fight to hold the work and position

with which they were satisfied. But no! Any talker on Tower Hill seems to mesmerise them, to sap their manliness, so out they come instead of standing like men against the tyranny of the mob. It is a pitiable exhibition. One would like to suggest a remedy. But what remedy will fit minds who reject the remedies they have demanded? What will suit men whose ideas of freedom are so perverted? We do not pretend to say who is responsible for the present outbreak. If it is the officials of unionism, we think they have done a bad day's work for their cause, for they have carried into every home the knowledge that a few men have no care for the many, and they are defeating the best ends of unionism. In fact, the present strike fever is an exhibition of inhumanity such as was displayed in '97 by the A.S.E. towards the unskilled men in the shops. It is not as if the men had not every chance. If they are not satisfied with the conciliation system as it has worked—generally in their favour—they could at least move constitutionally to amend it.

And finally, lest we be misunderstood, be it far from either our wish or our intention to deny that the strikers, or some of them, may have many or even serious grievances, or what may be as bad, may be suffering under annoying little vexations. Such are part and parcel of the employments of us all. With this we are not concerned at the moment, save to say that there are means for putting these grievances before impartial assessors. But conditions such as those of the tramway men—conditions better than many of them possessed when the tramways first started; such as the carmen have worked under for some time; such as the railway men have lived in since their last step upward—such conditions have not been so onerous that they can be held to justify this foolish threatened strike.

They are not new conditions even; they are a state of betterment on pre-existing conditions. They cannot by any stretch be argued to justify violence and intimidation. If these regularly-employed men think they are so badly treated that they must cease the work, let them cease and join the unprivileged army of workers, any one of which army would be glad to gain the rejected steady work.

The strikes of the past week, in face of the existing machinery for attending to grievances, are actually worse in their concomitant violence than those of years gone by, when the absence of all remedial means left no choice. We are not denying that there are matters that should be adjusted. But every right-minded citizen condemns the disgraceful accessories of this foolish attempt to coerce the whole public by terrorism. It will not serve.

MINERS' SAFETY LAMPS.

Ever since the introduction of electricity for lighting purposes, it has been thought that such a light would be the ideal one for the underground worker, provided it could be put into a suitable portable form. In the early stages the great objections were the excessive weight and cost. With improvements, however, in the manufacture of accumulators the weight began to diminish, until portable electric miners' lamps may now be obtained with a burning capacity of 10 to 12 hours, which weigh little more than an ordinary oil safety lamp.

The great objection, however, which is still held against the electric lamp by—we may say—most mining engineers, is that it gives no indication of gas, and failure to do this, they say, must be fatal to any lamp. We admit that there is certainly something in this, but not to the extent that the mine manager would have us believe; in fact, he really does not believe it himself for the simple reason, that there seemed to be so little chance of an electric safety lamp being produced that would at all compare with the ordinary oil lamp, that very little thought was given to the question.

At present, however, there is every indication that very considerable attention is going to be given to the electric lamp, and the offer of a prize of £1,000 for the best electric safety lamp is evidence that something better than the ordinary oil lamp, with all its advantage as a gas indicator, is very badly wanted, and in all probability the time is not far distant when the electric lamp will take the place of the oil lamp. This undoubtedly will be a boon to the miner and the mining industry, for nothing is so much wanted—next to fresh air—as a good light, and it is generally admitted that an electric lamp gives nearly twice the light of the common safety lamp. At one colliery in the county of Durham such lamps have already been introduced and nearly 2,000 are in use, and they are also being introduced into the collieries of the Whitehaven Colliery Co. Previous to their introduction at one colliery, considerable difficulty was experienced in connection with the oil lamps being all put out by an outburst of gas, which left the miners in darkness, so that they had to extricate themselves from the workings as best they could. One can imagine the disastrous results that might occur from a broken oil safety lamp under such conditions, but with the electric lamp there is no danger, as the light is entirely shut off from the outside atmosphere, and though one or two oil lamps may be necessary to indicate the presence of gas, these can be placed in such a position that they are more or less free from harm, and after being put out or otherwise giving an indication of the presence of gas, the light may be lowered or extinguished, and carried carefully in a safety zone, by the aid of the electric lamp. The chief point of interest about the introduction of electric lamp is that the number of oil lamps—although some may still be necessary for making examinations or otherwise indicating the presence of gas—will be greatly reduced, and consequently the risk of explosion due to a faulty or damaged lamp will be reduced in proportion—nay, more so, because the few oil lamps that would be in use would be in the hands of responsible officials who would naturally take every care of them. In fact, every oil lamp taken out of the pit lessens the danger in the mine, and every electric safety lamp introduced adds to the personal safety of the worker.

As to the possibility of the heated filament in the bulb of an electric safety lamp igniting gas, there is no question that this remains—and we are afraid will ever remain—a danger attached to any form of light. Safety in the electric lamp lies in the fact that the bulb entirely encloses the light-giving filament, and that the light almost instantaneously goes out when the bulb is fractured. The bulb itself is also protected by a thick glass, and the ideal lamp would be one so constructed that when the outside glass became cracked or broken the bulb would be automatically disconnected from the battery. But irrespective of this point, the electric lamp is undoubtedly safer than the oil lamp, as it is free from the danger of overheating, there is no wick or flame to watch and adjust, there is no gauze to get accidentally broken or overheated, and, most of all, there can be no tampering with an electric lamp, and if for any reason the light fails it must be sent to the surface, which at once gets rid of all "relighting troubles." Experience has shown, moreover, that ahe electric lamp is more reliable as regards retaining its light than the oil lamp. Often the slightest knock, being overturned, or going into a high velocity air current, will cause the latter to go out, and a non-lighted lamp usually means that work is stopped until it is either relighted or another lamp is procured.

As a means of detecting gas, at best the oil lamp is crude, and we have every hope that science will soon produce something to take its place that will be both more efficient and equally as reliable. With the oil lamp an experienced man can only estimate about 2½ to 3 per cent. of gas, and we have no doubt that once the mining industry begins to seriously appreciate the efforts of inventors in this direction, it will not be long before the several known appliances for gas detection will be developed and more or less perfected.

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HINTS TO MANUFACTURERS.

The manufacturers of electrical apparatus are, no doubt, constantly on the look out to discover the varied needs of their customers, and are anxious, with a view to extending their own business, to meet any demand which may arise. The steps by which they must arrive at their knowledge of these needs are, however, somewhat lengthy—the want being first felt by some wireman who grumbles about the matter to his foreman; the latter mentions the subject to his manager who in turn brings it to the notice of the travelling representative of some manufacturing firm; he, in his turn, speaks of it to one of his directors, who discusses it with his works manager, and if there seems to be money in it—if there is sufficient demand and the cost of production is not prohibitive—an article to meet the difficulty may eventually be put upon the market. Indifference or forgetfulness on the part of any link in this chain may obstruct or delay reform.

From time to time, therefore, it is helpful to bring directly before the notice of the makers of electrical supplies, from the point of view of those who are actually engaged in fixing them, some of the minor alterations in their apparatus which would be of most assistance in the carrying out of installations.

Take the case of the usual run of distribution boards. The stock sizes of these have the panels mounted on inch or inch and a quarter battens. For use when all the work is carried out with conduit buried in the plaster, such boards are possible, although, considering the projection of the terminals and cable sockets behind the panels, the space is undesirably cramped, and even a thin sheet of asbestos to keep the wires from contact with the wall may press them against the metal work—possibly of opposite polarity.

In the case of surface work, however (and very few installations of any size do not have at least one board where surface work is necessary), the effect of checking the batten over the conduit is to bring the live metal in dangerous proximity to the pipe. It would be a simple matter to replace the battens by thicker ones, but, unfortunately, this would not deepen the polished case, but would leave a gaping space between it and the wall. The workman's usual solution of his difficulty is the making of a 1½-in. frame (unless a joiner is available the mitres are not always as neat as could be wished) on which to mount the whole fuseboard and case.

The simpler and better way would be for manufacturers to provide more depth behind in the first place. It would increase the cost? Well, yes, it would slightly, but there are actually some contractors who could be persuaded to spend a few pence extra on the cost of material in order to save a shilling or two (and, incidentally, to make a better job) in labour. Makers will protest that they already supply such things when asked to do so. That is not the same thing at all: the foreman, though aware of the annoyance, may not think of asking for what is not listed; the contractor is afraid of the extra cost of anything not of standard pattern; in any case the delay in getting anything but "stock" articles is often prohibitive.

A somewhat similar trouble occurs with switch blocks. The usual thickness is a bare inch; "extra thick" blocks do not exceed 1¼ in. To cut these out to go over a piece of inch barrel or the end of a ¾-in. tee, leaves insufficient thickness for screwing to, and the block splits. An inch pipe may sound a large size, but it is nevertheless one in frequent use for ease in looping. With the larger blocks for a number of switches, *e.g.*, 6½ in. × 6½ in., 9 in. × 6½ in., &c., there are frequently several conduits brought to the block, and to fit the glued-on fillet over even a ⅝-in. pipe will cut right through it, and perhaps dislocate the mortice at one corner. There is no possibility of covering a ¾-in. conduit with lock nuts on the end for connecting an earthing wire across, nor, if the various pipes are finished into a three or four-way box, could that be covered. If wood casing is being used only the smallest sizes will finish nicely against the flat part of the side; the larger ones, whether containing mains or bunches of switch wires, having to have their capping fitted to the members of the moulding. Undeniably the thin blocks are much neater in appearance where sunk work admits of full advantage being taken of them, but thicker ones should also be listed as stock sizes.

The Institution rules (No. 56) recommend looping in preference to jointing, and the electrical contractor complies willingly, for experience has proved it economical. The accessories manufacturer has obliged by turning out ceiling roses and switches with larger terminals; but, if Rule 57 is to be conformed to ("the whole of the separate wires forming the stranded or flexible conductor must be contained within the terminal") something more must be done than has yet been attempted.

It would be fairly safe to assert that not one installation in 50 complies with this rule throughout. In any installation where the runs are lengthy *and proper allowance is made to avoid excessive drop in voltage*, there would be nothing uncommon in having a 7/21½ and two 3/20 wires to loop into a single terminal. This is a bad case, but by no means an extreme one, and yet it is unprovided for. It is hopeless to attempt to enlarge the hole in the brass terminal much more, and the only solution the wireman has is that of cutting out many of the strands before twisting the three wires together. One would suggest to the makers that *double* terminals be provided; the price would be increased somewhat, but that cannot be helped.

The same remarks apply to wall-sockets and to small cut-outs. Unfortunately they apply also to lampholders, which, on account of their small size, present a far more difficult problem. Nevertheless, it is one deserving the attention of designers who might, either by elongation or by a diametrical enlargement, whichever appeared to them least unsightly, gain space enough to contain double terminals. Even if it were sufficient for one pole only to be so treated, it would be a great help, for it is usually only the live wire and not the switch wire, which has to be looped. Needless to say, the 1⅛-in. barrel of the lampholder cannot be altered, or neither standard bayonet-cap lamps nor standard pattern shades could be used with it.

The fittings makers have ever been creators of worries for the long-suffering wireman; from early days, aided and abetted by the architect and the householder, his designers have delighted to produce brackets and electroliers, abounding in artistic flourishes and tasteful curves, but abounding also in sudden kinks and acute angles taxing the utmost skill to wire. Even with the plainer brackets the size of the tube is often insufficient. It is very unusual to find an ordinary 6-in. bracket listed of more than ½-in. tube, and if one of ⅝ in. is ordered specially, it will often be found on delivery (after some weeks' waiting) to be finished off with a nipple which reduces it at the end to take a ½ in. or ⅜ in. lampholder. The larger fittings and electroliers, though apparently made of ¾-in. tubing, are very frequently stiffened internally by ½-in. gas barrel—a strong, substantial fitting mechanically, but too small for easy looping (and looping which is *not* easy is not safe).

To design good fittings is not, in itself, sufficient; all badly-designed ones must be kept out of the catalogues. It is disappointing for a customer, who has chosen a fitting he likes, to have cold water thrown on his choice by the contractor. Mankind, and especially womankind, ever desires forbidden fruit the more, and it is not always politic for a contractor to oppose a client's wishes in such matters.

But, if fittings manufacturers are affected by Rules 56 and 57 in common with the makers of accessories, they are the ones *principally* affected by Rule 45, and yet have done nothing to help contractors to conform to it. Part of Rule 45 says:—"The connection between flexibles and hard wires may only be effected by screw-down terminals." The conduit maker has done something to this end by supplying porcelain connectors to fit in his junction and terminal boxes; the wood-block maker has provided a somewhat similar contrivance; the fittings maker has done nothing. Further, he should very possibly be blamed for having necessitated the enactment of this rule, in the first place, by having made his fittings with such small and shallow bases in the past that the joints crammed into them proved unsatisfactory. Whether that be so or not, he has failed to list fittings containing mechanical connectors such as would meet the requirements of this rule, although the rule has

been in force since April, 1907—and might have been anticipated.

Of course, there must be difficulties in contriving a neat and artistic arrangement in many cases, but there is nothing impossible in it. The brackets are likely to be the most troublesome, without enlarging the base out of proportion to the arm. With electroliers, pendants and standards, a deep base-spinning is an easy matter without spoiling the effect of the stem, &c. If this were done, and a ceiling-rose base (or some neater connector in two parts, so that the stem of the fitting can pass through between) fixed on a block inside it, any alteration of our present lampholder could generally be dispensed with.

Some rare fittings do have connectors in the ball at the bottom of the stem : good—if the stem is large enough to take the wires, say two switch wires and a looped black (one of which may be 7/21½), that is satisfactory, though, had it been at the top it would often have saved either wire or a joint, as it is impossible to know beforehand whether to leave the wires long enough to reach to 8 ft. from the floor, or whether to cut them short near the ceiling.

There are many excellent watertight fittings on the market, but most of them suffer from one defect—they are watertight everywhere but at the base. Of course, the maker has nothing to do with the fixing, so he is content to leave to others the problem of sealing the joint between his baseplate and the conduit, the former being made apparently with the idea that it would be screwed on to a wood block.

There are two ways of wiring for outside lights—one by running the conduit on the outside of the wall, the other by running it inside and punching through at the point where the light comes.

In the first case the bracket will be fixed on a box into which the conduit will be screwed. The standard conduit-boxes are not usually suitable for carrying a heavy watertight fitting, as they are of small diameter and only offer two shallow $\frac{3}{16}$-in. tapped holes for screwing to—not enough to support the weight nor to make a watertight joint. The best way would be for the fittings to have metal boxes, 1½ in. deep, supplied with them, their baseplates being fitted to the box as a lid.

To meet the second case the tube of the fitting should be screwed to take the coupling of, say, a ¾-in. conduit (*not* gas thread), and the backplate should be merely decorative, sliding on the tube and fixed where desired by a grub-screw. This would apply also, except as to size of pipe, to the large brackets from which arc lamps are hung ; the pipe from them, whether on the corner of a building or on the flat side of a wall, usually has to be carried through the wall and tightened by a locknut on the inside of the building. Such brackets are often made on the job, as those shown in a catalogue need too much adapting.

Reference has been made to the weakness of conduit-boxes as fixings for watertight fittings. It is a matter the conduit makers themselves should look to, not only for watertight fittings, but for fixings for *all* brackets and electroliers. As a rule, the boxes are covered by a disk of ebonite, or similar material, which is fixed on by two $\frac{3}{16}$-in. brass screws. If it is possible to screw through the baseplate of the fitting directly into these tapped holes, the ebonite is dispensed with, but usually the base overlaps the box, or, at all events, has three screw holes, so that wood screws into the disk have to be used ; in this case the ebonite is bent away from the box, except at the points held by the two screws. Even without the weight of the fitting the ebonite curls up when it gets damp (as it is sure to do during the plastering), so that it is most desirable that it should be held by three screws instead of two. If the ebonite were made thicker—say $\frac{3}{8}$ in. in all—it would be better, both because it would stiffen it considerably, and for another reason. In sunk work the building clerk of works insists on the conduits being buried perhaps a full $\frac{3}{8}$ in. below the finished surface of the plaster, as, otherwise, in drying, the plaster is liable to crack along the line of the pipe. With existing fittings it is necessary to make a slight double set from this depth to bring a box cover just flush on the wall, and even then a 6-in. length on either side of the box lies too near the surface, and the socket-lug of the box much more so. With thicker disks much of this could be obviated, and it would also provide a simple means of levelling one side slightly by planing off if the face were not quite lineable with the plaster. The teak blocks of the same thickness which are sometimes substituted, are certainly much too thin, even for fixing switches and ceiling roses on, as teak, even in stouter blocks, has a great readiness to split.

In using both ebonite and porcelain interiors, conduit makers are admonished to select only the very best of qualities, as these are, time after time, found to be responsible for bringing down the insulation test on an installation.—P.B.

[Note.—The numbers of I.E.E. Rules given above are taken from the 1907 edition. No. 56 is omitted now : No. 57 is re-numbered 75 and No. 45 is No. 53 in the new edition.]

A NOTE ON FLEXIBLE POLE-LINE SUSPENSIONS.

[communicated.]

In the earlier forms of power pole-line transmissions the practice in installing the insulators carrying the conductors was universally that of placing them on a rigid support attached to the pole, or a bracket placed upon it, thus following the practice at first found advisable in telegraph and telephone work. Comparatively recently, however, a new method of suspension giving an increased degree of flexibility has been introduced ; and as this advantage is combined with a type of design rendering the problems of insulation much easier of solution than with the rigid pin type of insulator, it has found a considerable degree of favour. Without in any way detracting from the undoubted advantages of the flexible type of pole-line suspension, however, it is worth while mentioning a point which, unless properly guarded against, may lead to trouble in particular cases.

Without entering into a detailed discussion of the properties of the catenary curve which is assumed by the conductor thus supported, the conditions of the case may be seen from one or two simple diagrams. Considering, first of all, the stresses upon a pole forming part of a straight pole-line transmission in flat country, we have such conditions as those shown in fig. 1. If P represents diagrammatically the

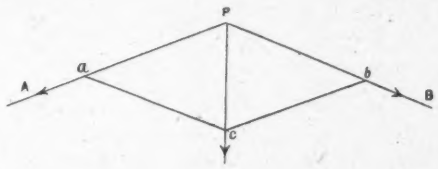

Fig. 1

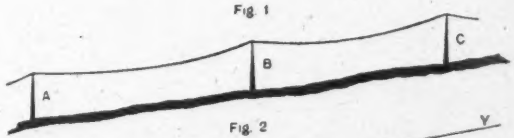

Fig. 2

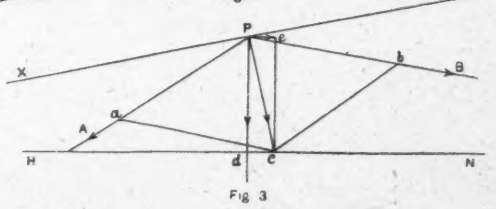

Fig. 3

point of support, and P A, P B represent the directions of the first elements of the spans passing to right and left of the pole, we may mark off distances P_a, P_b to represent the directions and magnitudes of the pulls at the end of the spans considered on the support P, due to the weight of wire in each span. Assuming that each span is equal in length, P_a and P_b will be equal, and their horizontal components will be nil. By completing the quadrilateral we find a component P_c, which is the vertical stress on the support of the insulator at P. Under normal conditions this value of P_c will be equal for each support, and equals the weight of one span of wire, except at the terminal poles of the transmission line when the force P_a or P_b is unbalanced, and

is resisted in full by the terminal pole or tower. It will be seen that so far as intermediate supports are concerned, it does not matter whether these are rigidly fixed or flexible, as the horizontal components are balanced, and P will not move laterally. The stresses both on the intermediate and terminal supports therefore remain unchanged within practical limits.

In considering the case where the transmission line passes over undulating country, however, the vertical contour of the country introduces disturbing factors. Suppose we take as a simple example the case of a long incline (fig. 2), on which there are three poles A, B, C, and consider the effect of converting the suspension at B from a fixed into a flexible one. The conditions of things at B can be seen from diagram, fig. 3, where the inclination of the ground and the sag of the wire have been exaggerated for the sake of clearness. If X Y represents the slope of the ground, and P the point of support, the elements of the two spans adjacent to P will branch off as shown at P A, P B, and it will be noticed that P A has a much steeper dip referred to the horizontal line H N than has P B. But since action and reaction in every element of the wire is equal, and as we assume the tension in adjacent spans to be equal, we can say that the pull P_a along P A, and the pull P_b along P B, are equal, and are represented by equally long lines. Completing the parallelogram in C we obtain an inclined resultant pull on the support P shown by P_c. Resolving this into horizontal and vertical components, we have a vertical stress on the point of support, P_d, and also a horizontal unbalanced pull (so far as the conductor is concerned) of P_e. When the point P is rigidly fixed, both these pulls are taken up by the supporting structure, P_d being taken as a weight and *c d* as a pull on the pole in the direction of the line, or in the case of a bracket or arm, as a twist on it. The spans between A and B, and B and C are, however, anchored at B as well as at A and C, so far as the rigidity of the poles will permit.

Now, suppose at B (fig. 2) the point of support is made flexible instead of fixed; that is to say, suppose the insulator is hung from the point of support by a flexible system of links. The horizontal pull P_e will draw the end of the link attached to the conductor in the path of the line uphill until the link lies in the path of the resultant of the forces exerted along the elements P A, P B. The effect of this is obviously to decrease, in a smaller degree, the sag in the line between poles A and B, and to increase it between B and C (fig. 2). Now the result of this on post A will be to make a flatter catenary at that point, and hence to reduce the vertical component of the forces acting upon it, *i.e.*, virtually to diminish the weight resting on it. Conversely at C the increase of sag increases the depth of the catenary, increases the vertical component of forces acting on it, and increases the weight on it. In other words, making B a flexible support has thrown weight from A at the bottom of the hill on to C at the top. One such transference may not matter, but on a long incline the multiplied effect, unless corrected in some way, may lead to unexpected happenings.

Not only is this the case, but by reducing the number of fixed points at which resistance is encountered to the horizontal component of the whole weight of wire contained in a series of spans, the whole duty of providing resistance is thrown on a few points, which may be either the end towers of the transmission line or the poles at which a change of level occurs. It will be seen that with a fixed suspension the horizontal component of the tension in the conductor is taken up in detail at the end of each span; free those ends in a large number of cases, and an accumulated effect is concentrated on a few points where the ground contours are uneven.

It is, therefore, evident that such conditions may, under certain circumstances of hilly country, involve a serious problem in the distribution of the stresses over the poles of the transmission line, as the highest pole tends to take more than its due proportion of the stresses. This difficulty has already been found in long pole lines having large spans passing up long inclines, even where the rigid type of support has been used, inasmuch as there is a certain amount of flexibility in the poles used. Where the supports are purposely made flexible, the matter needs to be even more carefully watched. Probably the best way of overcoming the difficulty is to space the poles more sparsely in the valleys and concentrate them more towards the top, giving shorter and flatter catenaries at the crests of the hills, and thus reducing the vertical components on the supports, while larger and deeper catenaries in the valleys would tend to level matters up as regards vertical stresses. This, combined with a judicious use of fixed supports where the horizontal components tend to congregate, in the way that a steam main is anchored at suitable points to prevent shifting, while leaving the body of the pipe work free to expand and contract, will probably render the flexible transmission line a most useful asset, even in most hilly country.

FUTURE PRACTICE IN ELECTRICITY SUPPLY.

Possible Amalgamation of Gas and Electrical Interests.

By "METROPOLITAN."

Perhaps the most astonishing feature connected with the inaugural address by the President of the Institution of Electrical Engineers last year was the almost entire absence of comment upon, what must have appeared to many connected with the electrical industry, the enormous field for development in the near future.

Either the majority of electrical engineers in this country regard that address as the words of "a dreamer of dreams," or they hold that a definite change in the practice of electricity supply of the nature indicated cannot be brought about within the lifetime of the present generation, and they are therefore apathetic on the subject.

There is no doubt that the aims and aspirations, as set forth by the President, are so important and far-reaching, embracing as they do not only the whole field of production in this country, but many important ethics of social reform, that angels (otherwise electrical engineers) "fear to tread" in these intricate paths of prophecy, and are content to wait in apathetic silence the coming of the "electrical age" by the sure process of evolution. But it is perhaps well in the interests of the present age to review in some measure the probable steps leading up to the future practice in electricity supply.

In the first place, there is neither room nor necessity for both electricity and gas in the industrial world.

The enormous improvement in electric supply and the increase in the applications of electricity within the past few years clearly prove that gas as an illuminant and agent of motive power must sooner or later become extinct.

In the domestic world electricity is now able to assume the supremacy for lighting, heating, cooking, &c. Recent improvements in cooking apparatus have shown us that not only is electrical cooking superior in every way to gas but the cost is not greater, while subsidiary saving on food stuffs is quite an important matter. The arguments which have been used in the past regarding the superiority of electric lighting over gas lighting, viz., benefit to health, subsidiary saving in the way of decorations, and, latterly, equality in cost, can now be relatively applied to electric cooking.

The only obstacle in the way of a fight *à outrance* with the gas industry is the short-sighted policy of supply undertakers in their methods of charging for energy used.

The actual cost of generating and distributing energy in most areas ranges from one-fifth to three-tenths of a penny per unit. If the standing costs of any undertaking are borne, as they should be, in due proportion by each consumer the sale of current at ½d. per unit for any purpose will produce a revenue sufficient to yield a handsome profit. In other words, every million units sold will yield £833 to £1,250 net profit after providing for interest and depreciation.

In municipally-controlled undertakings these profits are available for extending business by wiring consumers' premises, connecting to mains, and supplying meters, without the necessity of incurring debt for these purposes, which has in the past proved a serious obstacle to progress.

In the writer's opinion it should be an established law with every well-founded undertaking that capital should be raised only for land, buildings, plant and mains, and that normal extensions to plant and mains should not exceed the amounts set apart for depreciation and sinking fund.

By the adoption of a financial policy on these lines, it would be found possible to obtain sufficient annual revenue from consumers to pay all fixed charges upon any undertaking, and these charges would decrease as the extension of business permitted the adoption of larger generating units and corresponding increasing density of load upon the mains.

The fixed charges having been so arranged as to automatically decrease until an irreducible minimum is reached, the prospect of reducing the price per unit is one that must command the attention of engineers now as in the future. It has frequently been stated that gas undertakers could afford to supply their commodity at a nominal price relying upon their by-products to supply profits. This may be correct while they possess a monopoly of the markets for those by-products, but under any circumstances a sufficient return on the capital and administration costs of supplying gas would have to be obtained.

This appears to be the full extent to which electricity undertakers may be called upon to fight the gas industry; but it appears, without an entire revolution in the practice of electricity supply, as though it would become an unequal fight. When the cutting process is in full force (in some districts it has already commenced) electrical engineers will be compelled to adopt the practice, already foreshadowed by the President of the Institution, of distilling gas from coal for the purpose of firing boilers or driving internal combustion engines, and entering the market in competition with the gas industry for the sale of by-products.

In the writer's opinion there is no serious obstacle to such a practice being adopted and equal terms of competition with the gas industry thereby established. The result is obvious: without an outlet for the gas produced, the present producers could not exist. In the interests of public health, gas would not be allowed to waste to atmosphere, and therefore the industry would become extinct.

Considering the huge amount of capital, public and private, invested in gas undertakings, it is probable that the fight we are now entering upon will not be allowed to finish, and the possibility of amalgamation must be considered.

Already municipalities controlling both gas and electrical undertakings are finding the pinch of competition, and are adopting retrogressive tactics to avoid disaster to one or other of their trading concerns.

The only method of amalgamation which appears to be practical, allows for a universal supply of light, power and heat through the medium of electricity by utilising, at a nominal price, the available gas from the production of what are now known as by-products of coal. In the public interest it will probably be found more economical to utilise the existing plant and mains devoted to the production and distribution of gas, rather than to seek fresh capital for the development of gas plant in connection with electricity supply, thereby annihilating a large amount of public and private capital, a result which might be considered in the light of a national calamity.

In view of the emphatic prognostication of the President of the I.E.E., and the time and energy now being expended by engineers in advocating the claims of internal combustion engines, gas and oil, and generation of energy in sub-stations, it would perhaps be well if engineers generally devoted some time to the study of future practice in electricity supply from the aspect which appears to the writer to be the only logical and true form of evolution from existing methods of supply.

Compensation Claim.—At Burnley County Court, on August 11th, there was a claim by John Clague, of Castletown, Isle of Man, and Eliza Crossley, of Burnley, for compensation in respect of the death of John Clague, jun., electric overhead wireman, who was fatally injured whilst in the employ of the Burnley Corporation. On June 18th, deceased was repairing wires in Church Street when a portable furnace burst, and the petroleum set fire to his clothing. He sustained injuries which resulted in his death. Deceased's father was totally dependent on his earnings. The case was adjourned, and it was agreed that the father should receive 8s. per week and the sum of £10 down.

CONSUMERS' ACCOUNTS.

By George Johnson.

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On this basis the meter readings and consumption of energy as per the Meter Reader's Book, and other details, may be recorded in the Consumers' Register of energy supplied, which contains the details of the consumers' quarterly accounts, and after the former have been checked and the accounts prepared therefrom, such information as the debit columns of the Consumers' Ledger connote may be transferred thereto, the cash being posted to the credit columns from the Cash Book. As already indicated, there are other practices which vary more or less in working detail, but which do not call for any special observation. The meter readings and the consumption may be incorporated in the Consumers' Ledger without the intervention of a Consumers' Register if so desired.

The accounts unpaid, or the outstandings, are brought forward at the end of each subsequent quarter. For example, March quarter outstandings are brought forward at the end of June and inserted in the outstanding column commencing that quarter; similarly in June, September and December.

The total amount owing on consumer's account at the end of the year is, therefore, that shown in the "arrears brought forward" column under December quarter, in addition to the debits for the December quarter for energy supplied, the accounts for which are not rendered, of course, until January.

The amount thus owing is required to be specifically shown in the Board of Trade form of Balance Sheet, and we may proceed to prove the sum by the following simple procedure :—

Amount owing at beginning of year ...	
Add total debits for—	
March quarter	
June quarter	
September quarter	
December quarter	
Deduct—	
Cash received as per Cash Book ...	
Discounts allowed	
Other allowances	
Contra accounts, or amounts set off as per journal	
Amount of sundry debtors on consumers' account at end of year ...	

The motor accounts may be kept separately, and it may be noted that in the case of the sale of motors on the hire-purchase principle, each payment combines principal and interest. For instance, if a motor be purchased for £100, and sold on the hire-purchase basis for £120, to be satisfied by the payment of a quarterly payment of £15, extending over a period of two years, we may, without entering into a strictly correct actuarial computation, allocate the quarterly payment of £15 as to £12 10s. to the credit of the hire-purchase account, representing the repayment of the principal, and the difference of £2 10s. to interest, or hire, being the profit on the transaction, which is sufficient for all practical purposes.

TRADE STATISTICS OF MEXICO.

The following figures, showing the imports of electrical and similar materials into Mexico during the year ended June 30th, 1910, are taken from the recently-issued official trade statistics; the figures for the previous year are given for purposes of comparison, with notes of increases or decreases :—

Peso = 4s.

	1908-9. Pesos.	1909-10. Pesos.	Increase or decrease. Pesos.
Copper, brass or bronze wire, covered with other materials.—			
From Germany	58,000	70,000	+ 12,000
„ Austria	5,000	1,000	— 4,000
„ United States ...	279,000	389,000	+110,000
„ France	1,000	—	— 1,000
„ Great Britain ...	1,000	1,000	—
„ Other countries ...	1,000	—	— 1,000
Total ...	345,000	461,000	+116,000
Copper, brass or bronze wire, bare.—			
From Germany	24,000	26,000	+ 2,000
„ United States ...	87,000	119,000	+ 32,000
„ Great Britain ...	5,000	11,000	+ 6,000
„ Other countries ...	1,000	13,000	+ 12,000
Total ...	117,000	169,000	+ 52,000
Cables of copper, brass, &c., not armoured.—			
From Germany	51,000	41,000	— 10,000
„ Austria	4,000	4,000	—
„ United States ...	449,000	242,000	—207,000
„ Great Britain ...	3,000	2,000	— 1,000
„ Other countries ...	2,000	4,000	+ 2,000
Total ...	509,000	293,000	—216,000
Cables of copper, &c., armoured.—			
From Germany	90,000	61,000	— 29,000
„ United States ...	50,000	64,000	+ 14,000
„ Great Britain ...	17,000	53,000	+ 36,000
„ Other countries ...	5,000	5,000	—
Total ...	162,000	183,000	+ 21,000
Iron wire.—			
From Germany	125,000	167,000	+ 42,000
„ United States ...	231,000	342,000	+111,000
„ Great Britain ...	13,000	27,000	+ 14,000
„ Other countries ...	8,000	13,000	+ 5,000
Total ...	377,000	549,000	+172,000
Rails.—			
From Germany	59,000	403,000	+344,000
„ Belgium	40,000	101,000	+ 61,000
„ United States ...	2,894,000	4,340,000	+1,446,000
„ Great Britain ...	274,000	780,000	+506,000
„ Other countries ...	2,000	23,000	+ 21,000
Total ...	3,269,000	5,647,000	+2,378,000
Insulators of glass or porcelain.—			
From Germany	30,000	28,000	— 2,000
„ Austria	3,000	5,000	+ 2,000
„ United States ...	59,000	95,000	+ 36,000
„ Other countries ...	2,000	1,000	— 1,000
Total ...	94,000	129,000	+ 35,000
Commutators, interrupters, contacts, safety cut-outs, &c.—			
From Germany	144,000	77,000	— 67,000
„ Austria	10,000	5,000	— 5,000
„ United States ...	308,000	191,000	—117,000
„ France	7,000	2,000	— 5,000
„ Great Britain ...	4,000	12,000	+ 8,000
„ Other countries ...	7,000	1,000	— 6,000
Total ...	480,000	288,000	—192,000
Arc lamps.—			
From Germany	35,000	20,000	— 15,000
„ United States ...	29,000	32,000	+ 3,000
„ Other countries ...	5,000	1,000	— 4,000
Total ...	69,000	53,000	— 16,000
Incandescent electric lamps.—			
From Germany	67,000	275,000	+208,000
„ Austria	4,000	25,000	+ 21,000
„ United States ...	53,000	360,000	+307,000
„ France	—	10,000	+ 10,000
„ Great Britain ...	—	26,000	+ 26,000
„ Switzerland ...	—	8,000	+ 8,000
„ Other countries ...	3,000	—	— 3,000
Total ...	127,000	704,000	+577,000
Machines for industries, mining, &c.—			
From Germany	2,310,000	2,116,000	—194,000
„ Austria	16,000	6,000	— 10,000
„ Belgium	68,000	70,000	+ 2,000
„ Canada	18,000	—	— 18,000
„ Spain	55,000	32,000	— 23,000
„ United States ...	12,108,000	13,352,000	+1,244,000
„ France	497,000	371,000	—126,000
„ Great Britain ...	3,571,000	2,891,000	—680,000
„ Italy	35,000	17,000	— 18,000
„ Sweden	39,000	91,000	+ 52,000
„ Switzerland ...	145,000	159,000	+ 14,000
„ Other countries ...	15,000	31,000	+ 16,000
Total ...	18,877,000	19,136,000	+259,000
Carriages of all kinds for railways, &c.—			
From Germany	41,000	40,000	— 1,000
„ United States ...	1,489,000	1,747,000	+258,000
„ France	95,000	—	— 95,000
„ Great Britain ...	189,000	119,000	— 70,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	1,814,000	1,907,000	+ 93,000
Asbestos sheets, &c,			
From Germany	3,000	6,000	+ 3,000
„ United States ...	94,000	106,000	+ 12,000
„ France	2,000	1,000	— 1,000
„ Great Britain ...	1,000	3,000	+ 2,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	100,000	117,000	+ 17,000
Scientific instruments and apparatus.—			
From Germany	84,000	94,000	+ 10,000
„ United States ...	155,000	199,000	+ 44,000
„ France	56,000	82,000	+ 26,000
„ Great Britain ...	27,000	11,000	— 16,000
„ Italy	3,000	15,000	+ 12,000
„ Other countries ...	4,000	9,000	+ 5,000
Total ...	329,000	410,000	+ 81,000

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

"Australia for the Australians."

On April 28th you printed a very interesting interview with Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Australia, and I have been watching to see whether the British manufacturer had anything to say in his own defence. As he has remained, as usual, tranquil; and, as they say, "Onlookers see most of the game," perhaps you will kindly permit me to reply to some of Mr. Wickes's remarks. I have seen something of the Australian game, and I do not think the other side of the case should be left unstated.

First, then, take the "crying need" of Australia for new blood from Old England.

How does she treat it when she gets it? I am told by a working man, lately returned from that land of *promise*, that he was going to advise all his pals to stay here or go anywhere rather than to Australia. He said Melbourne was full of unemployed skilled men walking about looking for a job. They are tempted over by promises of work for all; and by that delightful little poem:—

> Eight hours' work, Eight hours' play,
> Eight hours' sleep, and Eight bob a day.

Arrived in Australia with his family, the skilled man soon finds himself reduced to that interesting condition so ably described by "The Self-Made Merchant":—"Root, hog, or die"!

He must work at something or see his family starve. The Unemployment Bureau is duly shocked at his quite exceptional misfortunes; promises work, but intimates that in a new country it doesn't do to be too particular—too "John Bullish" or "stand offish." So our skilled painter, glazier, fitter or boilermaker is sent up country as a labourer to the man who really wants him, and at whose instance the whole swindle is arranged, viz., the farmer.

There he is taken on as a "new chum." This engaging title means that not being Australian-born he must not be allowed indoors with the Australian labourers, who are nominally in the same rank and position.

There is a nice warm comfortable barn for him, with straw to sleep on, and plenty of fleas and rats for company.

He has to work hard at unaccustomed jobs; and is lucky if he just manages to send enough to keep his family in their lodgings in the city, till the harvest or the shearing is over, when he is promptly pitched out by the farmer and drifts once more in the streets—the noble representative of an imperial race!

I am told that fortunate ones sometimes get enough scraped together to get home—no assisted passage this time.

As to the British manufacturer, you say (or Mr. Wickes says) that he is shortsighted, that he is badly represented, and that he appears indifferent. We have heard all this before.

But the British manufacturer is a discriminating person; and there are lines of business which he really prefers to leave to his German and American friends. He does not at all mind their airs of superiority when they have secured the work.

You complain that it is not at all uncommon for British firms to ask the buyer—"usually a public body of some kind or other"—to inspect the goods and pass them at the works over here.

The Australian buyer asks, why do British manufacturers keep on asking for this? Why on earth shouldn't they? What *honest* reason can the buyer have for refusing such a reasonable condition. Surely if anything is wrong it is only reasonable that it should be discovered and rectified before the machine leaves the works. This is in the true interests of the *honest* buyer as it saves enormous delay and difficulty if anything is wrong.

The Australian buyer asks, "Why do not British manufacturers apply their own tests and satisfy themselves that the machine is going to do the work required?" Innocent buyer! Guileless dove! I will give him his answer. It is because the British manufacturer knows full well that it is not himself he has to satisfy in order to get his money. He has found by experience that perfection, as far as he can attain it, will not ensure the acceptance of the machine on the other side. He has discovered that public bodies in Australia are like public bodies here, only much more so, and that highway robbery is not quite extinct. Why are these people not willing to inspect at the makers' works?

There are plenty of reliable consulting engineers in London who would give an independent certificate as to whether the tests were satisfied or not. The reason why the Australian buyer prefers to have the goods first is obvious, and I may add that the system of getting the goods and then declining to pay for them is getting the colony a very bad name.

The British manufacturer supplies his best, pays carriage and an enormous import duty, and he then has to choose between fighting it out in an Australian Court, or compromising on a sacrifice of 20 to 30 per cent. of his money, and the object of the Australian buyer is attained.

I would respectfully ask Mr. Wickes whether he would not do better to advocate a fair and reasonable system of buying and selling, for after all he is the representative of that downtrodden worm, the British manufacturer.

Onlooker.

Olympia Electrical Exhibition.

While quite in accordance with the general contents of Mr. Seabrook's article in this week's REVIEW, in case it is not replied to officially, I certainly think if he will only "wait and see" he will find that the Executive Committee have made ample arrangements for the cooking side of the industry at Olympia.

With regard to his last paragraph, Mr. Seabrook has forgotten, or is not aware, that the caterers are appointed by Olympia, Ltd., and their methods of cooking cannot be controlled by the Executive of any exhibition held there.

At the same time the Executive made strong efforts to induce Messrs. Lyons to meet them with regard to electric cooking, but without success.

P. A. Lundberg.

Islington, N., *August 11th*, 1911.

Direct Coal Supply for London Electricity Supply Stations.

The present difficulty in obtaining coal in London owing to workers' strikes, tends to emphasise the suggestions contained in previous articles upon this subject which have appeared from time to time in the ELECTRICAL REVIEW.

That the present position of many concerns, more particularly up-river electricity works, is serious, no one will deny; and I take this opportunity of once again attracting attention to the advantages of bringing fuel from the coalfield seaports direct up-river alongside wharves in London. For this purpose any small steamer would serve, providing it was able to take the shore at low water without damage. Orders could be booked advantageously at the mining districts for f.o.b. at the nearest seaport, and the vessel would steam from there round the coast and proceed up river direct to its destination, without the delay and expense of unloading and barging. The only alterations to any vessel necessary to enable her to clear bridges would be that all standing rigging must be so arranged as to come down whilst proceeding up the higher reaches; it would not be a great expense to convert any ship in that manner.

The many electricity supply stations situated on or near the riverside in London offer splendid opportunities for a trial in this direction, which, I am sure, would prove successful and be a means of saving money by considerable reduction in coal bills. I mention trial here, in the sense of trying to bring a small vessel up river under bridges, with coal for an electricity works, although I know at least one other station, besides other firms, which have already tried the experiment with a hired ship, the result being a saving under those circumstances. Again, the gas companies, even up nearly to Putney, made a trial years ago, and results speak for themselves; they never reverted to the old method.

Of course, certain strikes would affect private ships, but little difficulty would be experienced in continually working a ship as suggested here. The crew would be picked men;

unloading arrangements in London would be secured; whilst with a little extra expense, delay in loading at the seaport would be overcome.

This matter is one affecting interests in many districts, and I commend it for consideration by those in authority at places on the river side up even so high as Putney, Hammersmith and Barnes. Money can be made at the business. The remarks recently published in the daily Press having reference to the annual report of the rival, gas, more than confirm it.

Interested.

Ventilation and Ozone.

In reply to the inquiry addressed to me by Mr. Ronald Grierson in your last issue, the formation of nitrogen compounds from air, during the use of high frequency apparatus, is due to the high temperature resulting from the spark discharges, and also to the dust and moisture present in the atmosphere.

A well-designed ozonizing apparatus avoids the conditions which produce these nitrogen compounds, in the manner described in my article. Both the Siemens & Halske and the Ozonair Companies are prepared to furnish clear proof that the ozonized air produced by their apparatus is free from these deleterious oxides of nitrogen.

John B. C. Kershaw.

West Lancashire Laboratory,
Waterloo, Liverpool, *August 14th.*

Telephone Charges.

The present outcry against excess charges for calls may possibly be due, in some cases, to the spite of the operators: it may also arise from the unauthorised use of the instruments by male and female assistants having conversations with their friends—which would not be recorded by the former.

It would appear that if counters (on wire) could be supplied to customers, as in the case of gas meters, the record on the dials could be compared at any time with the customers' record, and this would check most effectively any incorrect charges at whichever end of the line they originated.

Ernest Benedict.

August 14th, 1911.

The Insulating Properties of Leatheroid and Presspahn.

I have read the article on the above subject with much interest, but, whilst the results of Mr. D. H. Ogley's experiments are indisputable, I am of the opinion that his deductions are hardly justified.

He states that "presspahn retains its insulating properties under varying conditions . . . . Leatheroid, however, deteriorates rapidly as an insulator if damp . . . . For slot lining, presspahn would therefore be more suitable."

To gauge fairly the relative qualities of these materials, it is necessary to consider them under working conditions.

In every large works armatures are impregnated in a vacuum oven after winding. Now this operation has little effect in the case of presspahn but makes all the difference to the leatheroid. This is due to the fact of the presspahn having been previously dried out in the process of manufacture and its pores sealed by glazing.

It is well known that once this glazing is injured the insulating properties of the presspahn are very greatly diminished, and creasing is almost certain to take place whilst forcing the presspahn into the slots.

In the opinion of the writer the experiments made by Mr. Ogley, although in accordance with the practice of the National Physical Laboratory, do not make comparison easy, as two variables, time and voltage, are introduced. This difficulty is added to by the fact of the breakdown voltage not being inversely proportional to the time of application.

An easier comparison can be arrived at by keeping the time constant and raising the voltage gradually until breakdown occurs, taking, say, 20 seconds to accomplish this.

Some time ago the writer conducted a series of experiments on these lines which proved that leatheroid had a higher puncture voltage than presspahn. For instance, leatheroid 0·5 mm. thick punctured at 10,250 R.M.S. volts after having been dried for 12 hours at 100° C., whereas presspahn punctured at 7,500 R.M.S. volts.

To sum up, leatheroid is much tougher than presspahn and in consequence is far less likely to get damaged in the shop; it has a higher puncture voltage when dried out, and when impregnated is totally unaffected by moisture.

Presspahn is undoubtedly preferable for use in small shops not in possession of a vacuum oven, but these are in the minority.

Thos. J. Sack.

Walthamstow, E., *August 11th*, 1911.

Sag of Line Wires.

Mr. J. B. Sparks refers, in your issue of June 2nd, to the practice of measuring the sag, or dip, of wire by releasing one from its insulator and allowing it to hang free. He states that double the span gives four times the sag, and so by this method an easy way of measuring the latter is obtained.

I have used this system myself, and had no idea that it is not mathematically correct until I saw on page 207 of Vol. CLXIX of the *Proceedings* of the Institution of Civil Engineers a statement by Mr. Trotter as follows:—

"If a wire falls away from an arm it will hang with a double sag on a double span."

Investigating, I found the formula to be $L = l + 8d^2/3\,l$, and not $L = l + (8d)^2/3\,l$.

Possibly, though wrong in theory, the old system may be correct in practice, on account of the give of the poles. It certainly used to be given in the Telegraph Construction Code of the Indian Government, and has been largely used without bad results. Can any one of your correspondents throw a light on the matter?

Chili.

July 12th, 1911.

[The correct formula was given by Mr. Sparks in our issue of June 16th.—Eds. E.R.]

The Sphere of Government Influence.

It was with very great interest that I read your leading article in the issue of August 11th on "The Sphere of Government Influence"; it has always seemed to me to be a pity that a greater interest is not shown by trade papers in matters of this description. In one particular trade they say, "Our trade our politics." I do not wish to go as far as that. I do say, however, that if we viewed business more from the standpoint of political economy it would be better for us all.

A great deal of trouble at the present day is caused by misunderstanding as to the actual relationship existing between employer and employed, the laws of exchange, and the fundamental conditions of life; in many instances, we mar our Edens.

For the past 22 years I have been getting my living, and have worked as railway clerk—in running sheds, City offices, engineers' offices, shops, showrooms, as piecework foreman in iron and steel constructional work, labourer, foreman wireman, &c. I have always had this fact before me, that if you wish to retain a position you must invariably give satisfaction.

Having been engaged in diverse occupations, I have had an opportunity of studying the problem of employment from different standpoints, and I am thoroughly convinced that a solution of the labour problem does not lie in an increase of wages, but in a better understanding between "employer" and "employed," not overlooking the fact that an employer is also an employé, and so *ad infinitum*, and that both have in many instances interests in common, *i.e.*, the use of land, &c.

I have said if you wish to solve the labour problem, or endeavour to solve the problem, a better understanding must exist between employer and employé. You may ask what I mean. As a clerk my employer would always acknowledge me and return the salutation, he would provide decent lavatory accommodation, fire in office, &c., and my hands, face, clothes and general condition were such that I could go to a decent restaurant or tea rooms and secure decent meals with good company and congenial surroundings; the wages all round were lower than those of mechanics, but the

standard of general contentment was greater, simply because the employer acknowledged us and treated us more on the same footing.

How did my treatment as a mechanic compare with my treatment as a clerk? Well, in the first place, as a rule I have always found the lavatory accommodation very poor—sometimes filthy and abominable, and in some cases so disgusting that a decent man would be unable to use it. This is a thing which ought not to be allowed to exist; how can you expect to have a healthy and vigorous body of men around you unless you provide them with decent accommodation? As a rule, they have nowhere to keep overalls or wash their hands; and the decent, well-educated youngster soon degenerates and acquires the habit of the pig; he certainly is not a *persona grata* at any decent restaurant, even if there is one handy to the works. The consequence is, when meal times come he adjourns to the nearest dirty coffee shop or four-ale bar, where he pays the maximum amount of money for the minimum amount of refreshment, and you expect him to return to the works a refreshed, invigorated and contented worker.

I am well aware that many works provide mess rooms, but, as a rule, they are cheerless and badly managed affairs. My contention is, that a cheerful and well-conducted mess room and lavatories, managed on proper lines, would pay for themselves in every way. If only 10 per cent. of the employés for a start, used them, you would find that even they would have a leavening effect on the remainder, especially if the governor or manager looked in occasionally and told them how trade was going, &c., and treated the men as friends, not as inferior beings and enemies.

The fact is overlooked that many men are very sensitive and require careful handling, and that all foremen and managers, &c., are not necessarily possessed of tact, but are at times apt to be abrupt and brusque; thousands of pounds per annum are spent in our boiler houses, engine rooms and generating plants, individuals spend pounds on books and hours studying machinery and how to work it at its greatest efficiency without damage or detriment; but how about the study of man? We overlook the fact that the wages bill is generally the largest item in expenses, and that man is the most erratic and fickle machine we have to handle, and that to handle him efficiently and keep him from running hot we must manage him and know his funny ways and weaknesses; or, in other words, if you wish to control men you must make a study of mankind generally, remembering that he is not some sort of lathe or milling machine attachment, but a thing of flesh and blood—mortal, weak—and at times possessed of a liver and a wife.

We hear a great deal about the duty of the State to the individual; let us hear more about the duty of the individual to the State. Teach him and guide him; let him know it is not the money he earns, but the way he spends it. We want less economic waste and more useful expenditure of the nation's earnings, regardless whether a man earns £1 per week or £5,000 per annum.

The day of the small employer, who could take an individual interest in each of his employés, is past, and big combines, without a soul or conscience, have taken his place; and it seems as if the State is almost compelled to say to the employé, "If you are not wise enough to make provision against adversity and old age, we must legislate in such a manner that you will not be overlooked."

Space prevents me from writing more. We ought all to remember that, in many instances, circumstances make the man, and that man is very often debased or improved, according to his surroundings.

A. W. Wyatt.

Tasmania.—At a recent conference between a special committee of the Hobart City Council and representatives of the local tramway company, with respect to the proposal to municipalise the company's system, the latter said that if £250,000 were offered for the purchase, the matter would be considered. In its report the committee expresses the opinion that the limit the Council should go to should be £150,000.—*Australian Mining Standard.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Armorduct Conduit Fittings.

In the new conduit catalogue of the Armorduct Manufacturing Co., Ltd., of Farringdon Avenue, E.C., there are several fittings deserving of special notice. One of these, shown in fig. 1, is their latest type of the patent "Universal" screwed "knock-out" junction box. This box, under the most recent patents, is supplied stop-tapped to every one of the films, and it answers equally well as a one-way, two-way straight through, two-way corner, three-way or four-way junction box, and is also made with a back outlet.

Fig. 1.—Universal Screwed "Knock-Out" Junction Box.

Apart from the master patent covering the "knock-out" principle, the stop-tapping of the inlets is the subject of a separate patent. The boxes are supplied as standard with a heavy cast-iron cover, held by screws securing a watertight joint, but they are also made with improved-type screw-on lids. The inlets are of sufficient depth to provide six clear threads, thus affording electrical continuity and watertightness. Whereas it was previously necessary to carry a stock of five or six different types of boxes, one will now

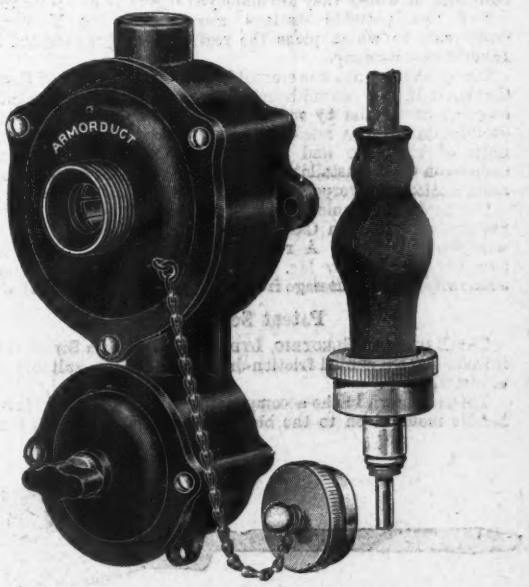


Fig. 2.—Combination Switch-Plug.

supply all wants. Other items include multiple oblong junction boxes, of which a want has long been experienced; distribution interiors designed for modern and high-voltage work, the special feature being that conductors do not cross each other or live parts of opposite polarity; floor inspection boxes which can be fitted with oak or brass covers, and for any size of conduit up to 1½ in. Among a variety of switch fittings is shown the combination switch-plug device appearing in fig. 2, which is a 10-ampere fitting particularly suitable for use in fiery mines, chemical works, &c., where special care is necessary owing to the existence of explosive vapours; also a line of multiple fittings boxes for surface work with interior mounting, a full selection of watertight lamp fittings, and a patent adjustable fittings box for flush work.

A Cavalry Wireless Set.

The August *Marconigraph* mentions, as an interesting instance of the various uses to which wireless telegraphy can be put, the employment of two Marconi portable wireless telegraph sets at the recent Investiture at Carnarvon of H.R.H. the Prince of Wales.

The two stations in question, which are of the Marconi's Wireless Telegraph Co.'s standard cavalry type, are the property of the Westmorland and Cumberland Yeomanry.

The stations are similar to those recently employed on the demonstrations in Turkey and Spain, and have been specially designed by the Marconi Co. to be capable of easy and rapid transport and to afford a means of communication between cavalry or other mounted units and the main body. Owing to the rapidity with which these portable sets can be erected and dismantled, the whole process lasts only a few minutes, and they are consequently of the greatest value from the military point of view. These sets have been spoken of in terms of the highest praise by the above-mentioned regiment, by whom they are employed regularly on all manœuvres.

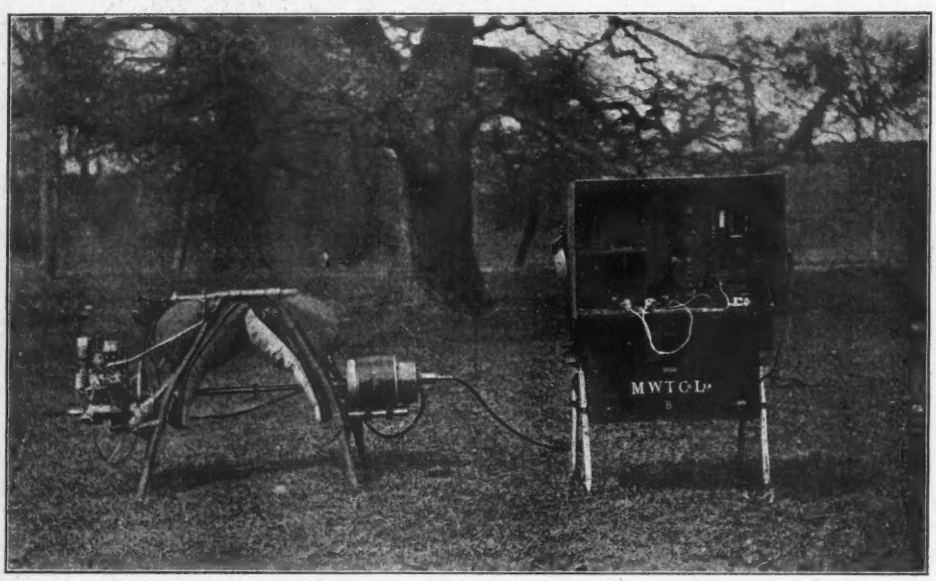


Fig. 3.—Marconi Cavalry Pack Set, comprising Engine and Dynamo, Transmitting and Receiving Apparatus.

The two portable stations accompanied the Yeomanry to Carnarvon, to which place the regiment had been ordered for the Investiture ceremony.

One of the stations was erected in the neighbourhood of Carnarvon Castle itself, the second being situated in the vicinity of the headquarters camp, and by means of these two installations, constant communication was established between the Royal yacht and the units of the fleet and the shore. Communication from the Carnarvon Castle installation was also established with the Government station at Liverpool and with the headquarters camp.

Constant communication was maintained between the Royal yacht and Carnarvon Castle by means of the Marconi system of wireless telegraphy. A respectful message of congratulation was sent from Poldhu by Mr. Marconi to the Prince, who graciously acknowledged this message from his yacht, also by means of wireless.

Patent Screwdriver.

The Benjamin Electric, Ltd., of 117, Victoria Street, S.W., are introducing a patented friction-drive screwdriver, suitable for the electrical trade.

This, as shown in the accompanying view, has a fluted insulating handle moulded on to the blade, with a loose cap which turns the handle and blade by a friction drive. A spring in the handle releases the cap on the reverse movement of the hand; the spring maintains a slight pressure on the screw constantly, holding the the blade in the slot. The driver will work in either direction, and is made in about a dozen sizes. It is simple in construction and comparatively inexpensive.

Fig. 4.—Friction-Drive Screwdriver.

The Multax Flame Arc.

The Globe Electrical Co., Ltd., of 11, Farringdon Avenue, E.C., has recently issued a pamphlet, M 60, describing the recent improvements in the Multax flame arc lamp, shown in fig. 5. The lamp is of the long-burning type, and suited for either A.C. or D.C. circuits; the working parts are completely encased and protected from fumes, while a patent replaceable inner globe is now provided, which, in addition to preventing deposit on the outer globe and protecting the arc itself from air currents, increases the burning hours by 25 per cent.—the 20-hour pattern giving 25 hours, and the 32-hour pattern giving 40 hours' burning, with the same carbon consumption. This represents a reduced burning cost, which the makers state is now approximately 25 per cent. below that of any other lamp employing Norris-Excello carbons; the trimming costs are also reduced in proportion.

A special feature of this lamp is the patent light-distributing reflector, fig. 6, consisting of a squat hollow glass ring, of tri-angular section, with inclined reflecting surfaces, heavily silvered inside, the result of which is that the maximum angle of the light is altered from about 70° to the more useful angle of 30° to the horizontal, an innovation of particular value in street lighting and similar work.

Fig. 5.—Multax Flame Arc Lamp.

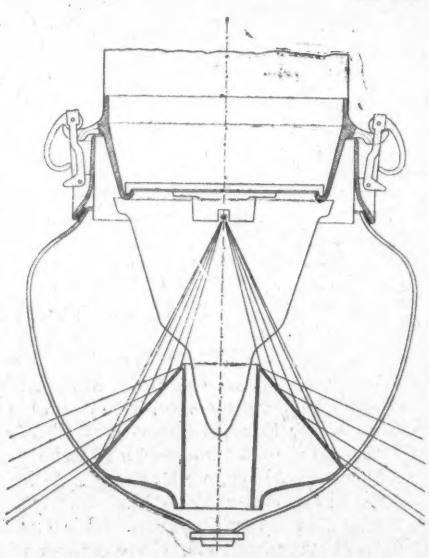


Fig. 6.—Light Distributing Reflector, Multax Lamp.

The list M 60 gives full particulars and prices of these lamps and accessories.

A New Insulating Material.

A new insulating material, known as "Pelollit," which hails from Cologne, but will be manufactured in Wolverhampton very shortly, is being put on the English market by Mr. A. J. Faulding, of 265, Strand, W.C.

The material, which is claimed to be an excellent electrical and heat insulator, is put on in layers, consisting alternatively of an elastic filling material and an agglutinant, and has a smooth,

polished, non-cracking surface. It is impervious to moisture, and, we understand, comparatively cheap in cost.

At the present time Pelollit is being applied for heat-insulating purposes to the handles of saucepans, for coating the insides of safes, &c., and in place of moulded insulation and insulating enamels for electrical work.

A sample insulation which we have examined was composed of six layers, giving about 1 mm. thickness, and is suitable for insulating 400° F. temperature or electrically insulating 2,000 volts pressure.

Metal-Filament Lamp Fittings.

Messrs. J. & H. Grevener, of 40, Southwark Street, S.E., have met with considerable success in their lanterns and fittings of various types for metal-filament lamps, of the newest of which we give illustrations herewith.

Fig. 7 illustrates one of the firm's No. 305 fittings, for which they have received, amongst others, an order from H.M. India Office for 2,300 fittings for use at the Delhi Durbar Coronation festivities. This is a well-finished fitting, suitable for lamps up to

Fig. 7.

Fig. 8.

600 c.p., and is supplied with clear or opalescent globe; it is made on arc lamp lines, with sound insulation for suspension and leading-in wires, and the holders are provided with stout porcelain covers.

Fig. 8 is an aluminium fitting, with either clear or opalescent glass globe. The design is a comparatively cheap one, but is perfectly reliable.

Reyrolle Motor Starters.

The accompanying illustration shows the latest lever type motor starter made by Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne; these starters are fitted with the firm's patent "current-growing" resistance, which, by the use of carbon, obviates the

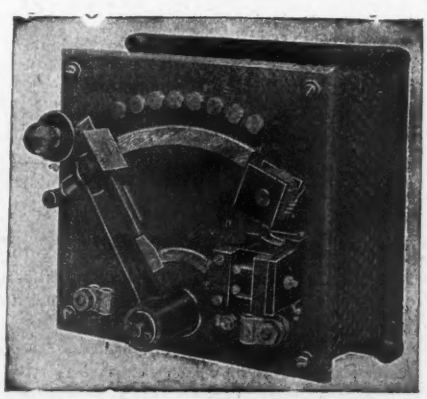


Fig. 9.—Reyrolle Motor Starter, Open Type.

tendency of resistance wires to fuse or break, and at the same time possesses the property of allowing the current to increase while the lever remains on the first stop, until the motor starts. The type illustrated is provided with no voltage and overload releases.

"S.V.P." Motor.

The Electric Construction Co., Ltd., of Wolverhampton, have recently introduced a cheap but well designed small motor, known as the "S.V.P.," which is at present offered in the ¾ B.H.P., 1,000 R.P.M.; 1 B.H.P., 1,400 R.P.M.; and 1½ B.H.P., 2,000 R.P.M. sizes.

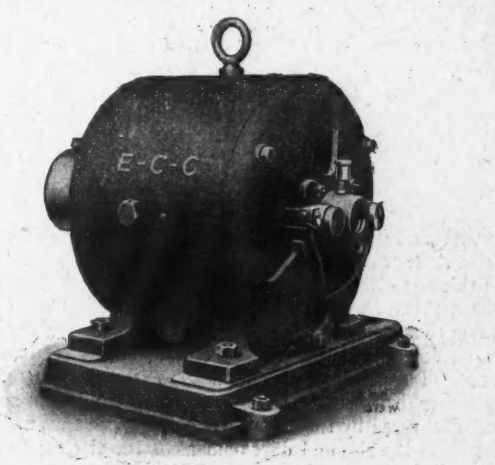


Fig. 10.—"S.V.P." Motor.

A temperature rise not exceeding 70° F. after six hours' full load running and an overload capacity of 25 per cent. for two hours and 50 per cent. momentarily are claimed. The feature of the S.V.P. motor is its vertical commutator shown in our view. The brushes are spring controlled and adjustable as to pressure, and the design enables them to be easily got at, although the machine is of the protected type—it also results in a shorter machine.

SMOKE ABATEMENT IN LONDON AND HAMBURG.

By JOHN B. C. KERSHAW.

The reports of the London and Hamburg Smoke Abatement Societies for the year 1910 have been published recently, and they contain much of interest for readers of this Review. It has been left for Glasgow to discover that the electrical engineer, apart altogether from his occasional appearances in Court as an offender against municipal by-laws in connection with smoke emission, is very directly concerned with this problem of smoke abatement. In the autumn of 1910, the Glasgow Corporation organised a Smoke Abatement Exhibition for the benefit of their citizens, and achieved a success both as regards attendance and receipts, which was far beyond that realised at any previous Exhibition of this character. Whether this success was due to the unusual spectacle of the engineers and chairmen of the Gas and Electricity Committees of the Glasgow Corporation fraternising together in friendly rivalry, instead of slanging each other in the columns of the local and technical Press; or whether it was due to the organising ability of those who arranged the Exhibition, and the genius possessed by Glasgow people for making a success of anything; the fact remains that the attendance averaged 4,000 people per day during the three weeks for which the Exhibition was open, and that a large amount of business was obtained by the exhibitors as a direct outcome of their displays at the Exhibition. A further result of the Glasgow Exhibition was that sufficient public interest was aroused to justify the organisation of two series of public lectures on smoke abatement for the winter of 1910-11; one for working men and boiler attendants, and the other for householders and the general public.

In view of these facts, and of the intention of Manchester and London to hold similar joint Smoke Abatement Exhibitions in November and May of 1911 and 1912 respectively, the following summaries of the Reports of the London and Hamburg Smoke Abatement Societies for 1910 should prove of value.

London.—The most striking feature of the Report of the London Society is the table showing the great improvement

in London's atmosphere, for the three periods of nine years each, since 1883. The following are the figures and comments from this section of the Report :—

Period.	Days with fog.	Hours of bright sunshine.
1883-4 to 1891-2	29·9	55·6
1892-3 to 1900-1	20·7	70·1
1901-2 to 1909-10...	10·6	93·5

During the winter of 1909-10 there were only seven foggy days, and there were 118 hours of bright sunshine.

It is not, of course, suggested that this welcome result is more than partially due to the suppression of smoke nuisances in connection with factories and trade concerns, for the domestic chimney, which in the past has been a great offender, has certainly also shown remarkable improvement. This, no doubt, is largely due to the increasing use (for heating and cooking) of gas, electricity and solid smokeless fuels, such as anthracite, carbo, coalexld, coalite and coke. In this connection it should be remembered that Dr. W. N. Shaw, F.R.S., the director of the Meteorological Council, has stated that 20 per cent. of the fogs in London are wholly due to smoke, while the density of all other fogs is greatly increased by the presence of smoke in the atmosphere.

Although it is not specifically mentioned in the report, the period covered by these figures coincides with that which has witnessed the rise and development of the electric light and power industry in this country, and electricity can certainly claim its share in bringing about this marked improvement in the London atmosphere.

Concerning factory smoke, the Committee of the Society reports that within the area known as Greater London, there are no fewer than 35,000 factories and workshops. When the Society commenced its operations in 1899, it may be safely said that the large majority of those premises more or less frequently emitted black smoke. Now, only a small minority offend, for most manufacturers have learnt that, to their own pecuniary advantage, they can carry on their work without causing smoke nuisances. The effect of the Society's system of inspection is really striking. Observations are made in a district, and in a short time the Society's reports generally lead to the temporary cessation of nuisances.

As regards the active work of the Society during the past year, 1,094 cases of smoke emission were reported by their inspector, and were investigated by their Committee, and in the majority of instances the Society reported the nuisance or complaint to the Borough Council or other local authority concerned. The Committee state that, on the whole, Borough Councils may be said to discharge their obligations to the public is suppressing smoke nuisances. The inaction of a few public bodies, such as the Southwark Borough Council, stands out in unpleasant relief. It is to be hoped that the time will arrive, when it will be universally recognised that to foul the air we breathe is as reprehensible as it is to pollute the water we drink, or to adulterate the food we eat. Then, perhaps, it will also be fully recognised that smoke nuisances may be abated without harassing trade, and also that such abatement results, in most cases, in considerable profit to the manufacturers.

The failure of the London County Council's attempt last June to amend the law in relation to smoke nuisances within the metropolis ; the Conferences and Exhibitions held in 1910 at Edinburgh, Sheffield and Glasgow ; and the deputation organised by the Smoke Abatement League and received by Mr. John Burns on June 23rd, 1910, are dealt with in the remaining paragraphs of the Report. The following appeal closes the Report :—

"It is only by incessant vigilance and effort that the smoke evil can be successfully encountered, and the Society appeals for funds to enable it to continue its work on the lines of that of the past 13 years. The Committee feels that the Society's efforts deserve greater support than has hitherto been bestowed upon them. With an income of only £200 per annum, much has admittedly been accomplished by the Society. It has been shown that smoke abatement is no idle dream ; that, without harshness to manufacturers, local authorities can deal satisfactorily with a great deal of factory smoke ; that, indeed, the manufacturer can in almost all cases effect striking economy in his working expenses by using the means which modern research has rendered possible for securing the maximum advantage from bituminous coal ; and, finally, that the private householder, by using smokeless methods of heating and cooking, can contribute his share to the cleansing of the atmosphere.

"But much remains to be done before the idea of the practicability of a pure air can be spread broadcast in the minds of the public, and the Society appeals for a generous extension of the financial support hitherto accorded to its efforts."

Hamburg.—The eighth annual report of the Hamburg Society is as usual much more technical in character than the report of the London Society, and it is unfortunate that the eight valuable reports of this organisation are not more widely distributed, and read and studied in this country. The difficulty is, of course, partly due to the fact that they are only published in German, and that the average educated Englishman's acquaintance with this language is limited. Some enterprising publisher or public authority might, however, arrange for the translation and publication of these reports in this country as they appear. The London County Council, which has been empowered to spend £500 per year "in investigating and advancing measures with respect to smoke consumption and the abatement of nuisance arising from smoke," might devote a portion of this sum to the purpose named ; or, possibly, the London Coal Smoke Abatement Society, or the Smoke Abatement League, could undertake the duty.

The Hamburg Society, as the writer has more than once explained in print, is a voluntary Association of steam-users, with works located in or around the city of Hamburg, and the Society maintains its own staff of engineers and firemen instructors, who have the complete control and oversight of the steam-raising and heating installations of its members.

The Society is managed by a Committee of its members, who are themselves all manufacturers, and has a staff of four engineers and four firemen-instructors devoting the whole of their time to the plant of the members.

The Committee of the Hamburg Society have to report for 1910 a decrease in the membership, due not to falling off in support, but to the formation of a new branch society with its headquarters in Helsingfors, Finland. The formation of this new society, on the lines of the Hamburg one, has carried off the Finnish members of the parent body ; and the register of the latter now contains the names of 401 members, with 1,325 boilers and furnaces, under the control of the Society's officials. The Committee in their report refer to the publication of a new monthly paper entitled *Rauch u. Staub*, the Editorship of which was offered to the officers of their Society ; and also to the results of their work in connection with the abatement of smoke from steamers lying in the port or river of their city.

The chief engineer of the Society in his Report summarises briefly the aims and methods of the Hamburg Society, and these may well be reproduced here for the benefit of those of our readers who are not acquainted with its history or organisation.

As regards the aims of the Society, the chief engineer (Herr Nies) states on page 7 of the Report that the governing idea is to improve the skill and efficiency of the firemen, and to develop, at the same time, their interests in the subject of smoke abatement. These aims are realised by the education of the stokers in the management of their boiler fires ; and by the continuous oversight of their work, exercised by the officers of the Society. The work is judged by the completeness of the combustion process, as indicated by the absence of smoke, and by tests of the exit gases, in order to determine the amount of excess air, which is being passed with these gases up the chimney.

A further department of the Society's work relates to proposals for improvements in the construction or settings of grates and boilers. The object here is to save members of the Society from excessive or unnecessary expense, and to recommend only appliances or designs which have been proved by actual trial to be of value. Advice relating to the purchase of fuel is also given by the officers of the Society, and here again expense is saved, by dispensing with the use of the high-priced smokeless fuels, except in special cases. The advice as to coal purchase is based upon the analyses and calorific determinations of the many hundreds of fuel samples that have been made at the Society's instigation in the years 1909 and 1910, the results of which are included in

the last two reports. The calorific value is also employed, when possible, as the basis of the contract between buyer and seller.

As regards smoke prevention, the officers of the Society depend chiefly upon the regulation of the secondary air supply, since in most cases this method can be applied without great or expensive structural alterations in the grates or furnaces. The fact that smoke is most generally caused by a deficiency in air supply rather than by a deficiency in temperature, proves (they consider) this method of treatment to be correct, and alterations in the furnace structure to be uncalled for. The investigations of mechanical methods of stoking during the past year have been confined principally to the chain-grate stoker and to the underfeed stoker. The use of economisers has been recommended in many cases where heat losses were occurring, either as a result of too high demands upon the boilers, or of bad design and arrangement of the heating surfaces of the boiler and flues.

As regards the active work of the Society, the Hamburg organisation, unlike the London one, devotes itself chiefly to the observation of boiler fires and flues, rather than to the watching of chimney tops, and has the following record of work performed during 1910 :—43 first tests of boiler installations ; 76 second tests ; 664 revision tests ; total, 783 tests. As the larger number of these tests represented an eight hours' steam trial of the boiler or boilers, with all the usual incidental tests of feed-water, fuel, steam, and waste gases, it will be seen that the officials of the Hamburg Society are kept fairly busy. The revision tests, it may be stated, are carried out at regular intervals, to see if the improved efficiencies due to the earlier trials as the result of improved stoking, or alterations in draught or furnaces, are being maintained.

The final section of the 1910 Report, which extends to 80 pages, is devoted to a record of the 800 odd fuel tests, carried out at the official testing laboratory of the Society in Hamburg during 1909 and 1910. The larger number of these tests refer to English and Scotch coals, and that portion of the Report containing the test figures can be obtained as a separate pamphlet.

The German methods of carrying out the tests, and of calculating the calorific value of the fuel, are different however from the English methods (see Electrical Review, February 10th, 1911), and those of our readers who obtain this pamphlet must make allowance for this difference when comparing the English and German test results for the same classes of coal.

BUSINESS NOTES.

Consular Notes.—Canary Islands.—The British Consul at Las Palmas reports that the electric tramway was completed in August, 1910, and since then a most excellent service of cars has been run between Las Palmas and Puerto de la Luz—4 miles. It is interesting to note the various sources of supply for the whole construction. Boilers, generating sets, iron chimney to power station, cranes, and much machinery and tools are British ; pumps American. The dynamos, switchboards and road posts, as well as carriages, are all from Germany. Rails and all roadway ironwork, also ironwork for sheds and power station building are from Belgium. Storage batteries are from Spain, and copper cables from France.

France.—The British Consul at La Rochelle reports that the electric lighting of La Pallice, at present supplied direct by the La Rochelle lighting station, is to come into the hands of the Chamber of Commerce, which will have a transforming station at the dock to supply the quays and various warehouses.

Italy.—The British Vice-Consul at Savona reports that the Societa Elettrica Riviera di Ponente Ing. Negri, which was formed to utilise the hydraulic powers of the Roia, has found it necessary to build at Savona a steam-electric central station of large power, in order to cope with any eventual deficiencies of hydraulic power. The company supplies power to the Societa Giderurgica of Savona and to the local gas company, and also to several small towns and villages, among which are Albasola and Celle.

Japan.—The British Consul at Nagasaki reports that the laying of a new cable from Mogi (about 5 miles from Nagasaki) to Tamsui, Formosa, a distance of 655 miles, was completed in October last, and the service was at once opened. The cable came from the United Kingdom. In October the Department of Communications acquired from the Great Northern Telegraph Co. the submarine cable between Fusan and Tsushima. A new telegraph rate to Corea has accordingly resulted, and a message can be sent from Japan to Corea at the rate of 40 sen (10d.) for the first five words, and 5 sen (1½d.) for each additional word, with the same rate to Formosa instead of 30 sen (7½d.) a word as formerly. The purchase price is given as 160,000 yen (about £16,000.)

Spain.—The British Consul at Seville reports that the monopoly hitherto held by the Compania Sevillana de Electricidad, a Spanish company with German capital, is likely to be invaded by competition. The Sociedad Catalana de Alumbrado por Gas, a powerful Spanish company, till now a producer of gas only, has decided to supply electric current for lighting and industrial purposes. This company already has a contract for lighting the town by gas, but in response to the desire of the Town Council, this will now be substituted by electricity. The necessary contract will be given to the Spanish company as soon as it is in a position to carry out the work. An Englishman, Mr. Bailey, is the local manager.

The British Consul at Cordoba reports that no progress has been made so far in the projected electric tramways for the city, though various schemes have been propounded, and the authorities are anxious to see them carried out, more especially one to facilitate access to the charming southern slopes of the near Sierra, which are attracting more visitors every year in search of a mild winter climate amongst the orange orchards of this delightful neighbourhood.

France.—In connection with the scheme for the construction of an enormous barrage across the Rhône at Genissiat, below Bellegarde, which would form above stream a lake stretching up to the Swiss frontier and covering over 900 acres and down stream a waterfall with a drop of some 220 ft. capable of generating electric power averaging 170,000 H.P., to be conveyed by overhead wires to Paris for various industrial purposes. H.M. Consul at Lyons now reports that this project, to which reference has already been made in the Electrical Review, has encountered considerable opposition from various local interests affected, partly on the ground that it would involve the disappearance beneath the waters of the artificial lake of whole villages on or near the river banks, and would, moreover, destroy the famous Perte du Rhône, close to Bellegarde, where the river takes a headlong plunge into the bowels of the earth and is lost to sight for some 100 yards—a curiosity which attracts about 4,000 tourists a year to the spot—but chiefly on the score that it would rob the neighbourhood of its vast natural heritage, in the shape of the white coal, latent in the waters of the river, and would carry it off to Paris. Two counter schemes have, therefore, been formulated to take the place of this project and they are receiving considerable support locally. The first of these has been presented by the French company who are actually exploiting the natural fall of the Rhône at Bellegarde, 50 ft. high, and distribute the electrical energy thus generated among a number of consumers in the Departments of the Ain and Savoie. The scheme involves the construction of a large barrage on the site of their existing dam, above the Perte du Rhône, which would thus be preserved, forming a lake stretching up to the Swiss frontier, which, unlike the Genissiat Reach, would not engulf a single dwelling. Two large power houses would be constructed, one at Coupy, close to the barrage, and the other at Elvise, which, together with the existing station at Bellegarde, would be capable of generating nearly 200,000 H.P. in summer and 100,000 H.P. at low water in winter. The second scheme, formulated by another French company, is not in antagonism with the first, but rather serves as a complement to it, and contemplates the construction of another barrage, creating a second smaller lake three miles long, below the larger one, and forming a fall some 65 ft. high, capable of generating a minimum of 30,000 H.P. The total electrical energy thus produced would be at the service of the industries of the neighbourhood, and would, doubtless, lead to the erection of many electro-metallurgical and electro-chemical works in the area which it would serve. It need therefore be scarcely a matter for surprise that these alternative projects are regarded with more favour locally than the more ambitious Genissiat scheme, which is designed to carry off to Paris the power which, in the opinion of the Departments interested, should be kept for home use.

The Government will shortly erect, at an estimated cost of £40,000, a large power house on the River Drac (Isère) for generating by water-power the electricity required for working a new railway to be constructed by the State from La Mure, the coal mining centre, to Gap (Hautes Alps) on the Paris, Lyons and Mediterranean Railway from Briancon to Marseilles, thus connecting the coalfields directly with the chief port of France.

H.M. Consul also reports that the experimental installation at Lyons of the Lorimer system of exchangeless telephones, though originally designed to last for 12 months, beginning November, 1908, was eventually prolonged for another year, and only came to an end towards the close of 1910. The unqualified success of the experiment after so thorough a trial was signally proved by the general reluctance displayed by those favoured persons—200 in number—who had been supplied with the apparatus, at being compelled to return to the ordinary method, after having tested the joys of a telephone that worked independently of a central exchange. There does not, however, appear to be any immediate prospect that the State will definitely adopt the Lorimer system, though the question is still under consideration.

Shortly after the disastrous post office strike in 1909 a wireless telegraph station was temporarily established by military engineers on the metal tower that stands on the height commanding Lyons, but after some months the experiment was discontinued. Wireless communication has, however, again been opened with Paris—this time through the enterprise of one of the principal watchmakers, who has established an apparatus in the metal tower which receives the time daily from the Eiffel Tower in Paris, and transmits it to his establishment in the centre of the town.

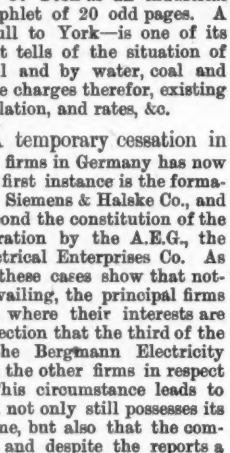
A New Austrian Cable Factory.—It is reported from Vienna that the Ganz Electricity Co. and the Austrian Siemens-Schuckert Works intend to establish a cable factory at Pesth.

Belgian Enterprise in Russia.—The Société de Tramways et d'Electricité en Russia, which was recently formed in Brussels with a share capital of £400,000 for the acquisition from the German Electrical Enterprises Co., of Berlin, of the latter's supply works or tramways in Russia, is now one of the promoters of the Tramways et Eclairage Electrique de Simteropol which has been constituted in Brussels with a capital of £1,400,000. The other promoters are the Belgian investment companies, known as the Société Générale Belge d'Entreprises Electriques, and the Financière de Transports et d'Entreprises Industrielles.

York as an Industrial Centre.—A good deal of useful information regarding the City of York as an industrial centre is given in a recently issued pamphlet of 20 odd pages. A plan of the River Ouse navigation—Hull to York—is one of its features, and the matter in the booklet tells of the situation of the City, its transport facilities by rail and by water, coal and water supplies, electricity supply and the charges therefor, existing industries, tramways, factory sites, population, and rates, &c.

Co-operation in Germany.—A temporary cessation in the co-operation of the leading electrical firms in Germany has now been replaced by two associations. The first instance is the formation of the Ozone Co. by the A.E.G., the Siemens & Halske Co., and the Felten & Guilleaume Co., and the second the constitution of the Hydraulic Power and Smelting Corporation by the A.E.G., the Siemens-Schuckert Works and the Electrical Enterprises Co. As pointed out by a Frankfort newspaper, these cases show that notwithstanding the competition still prevailing, the principal firms continue to combine as a closed force where their interests are identical. It is noteworthy in this connection that the third of the still completely independent firms—the Bergmann Electricity Works Co.—also stands in no relation to the other firms in respect of the two transactions in question. This circumstance leads to the supposition that the Bergmann Co. not only still possesses its complete independence at the present time, but also that the company intends to proceed on its own way, and despite the reports a little time ago of schemes of association with the Siemens group. It is concluded, in any case, that the development of the mutual business relations between the large firms deserves constant attention, as it can offer certain bases as to how far and how long the existence of independently working firms can still be spoken off as existing in Germany.

Filaments of Adamant.—The accompanying illustration has been reproduced from an untouched photograph taken of an Osram lamp sent to the G.E.C. by Rawlings & Co., of 303, High Street, Lee, Kent. This lamp has recently undergone and withstood an unusual test. For some considerable time past it has been burning in a private garage in Kent, and on Thursday last it was struck by the rear part of a car backing into the garage. It is of interest to record that the only damage done to the lamp was the indentation of the cap as shown in picture, the filament after the collision being found absolutely intact.



Fires.—Mr. H. W. Teeton, electrical and mechanical engineer, announces that owing to a fire which occurred on 11th inst., resulting in the total destruction of his premises and stock at Foundry Works, Hanley, he has removed temporarily to 19A, Lichfield Street, Hanley. The whole of his catalogues, lists, &c., having been destroyed, and he will be glad to receive further copies from manufacturers and factors.

Messrs. H. N. Morris & Co., Ltd., Gorton Brook Chemical Works, Manchester, ask us to state that the fire which occurred at their works on August 7th will not in any way interfere with the output of their products.

Street Lamp Lowering Gear for M.F. Lamps.—We have before us some street views showing some of the installations of lowering gear recently carried out for metal-filament lamps by the London Electric Firm, of Croydon. Though at first sight it might not appear warrantable to fit such gear, seeing that the lamps only require attention (either for cleaning, replacing defectives or worn-outs), say, once a month; yet a calculation of the cost of such attention, with the time and labour involved in the use of tower wagons, is claimed to amply justify the installation of such gear. In cases where the gear is already installed for arcs, it can be used without any alteration whatever, except in cases of two (or more) circuit clusters, and in these cases the cost of alterations are very small. The contact-suspension device is of the firm's positive-acting weight-relieving type, and the winch of their self-sustaining pattern, without ratchets, pawls, springs or triggers. One of the views is of Watling Street, E.C., others hailing from Covent Garden, W.C., Croydon, &c.

Metal Lamp Patents.—We are informed that in an action brought in the Chancery Division of the High Court of Justice by the Osram Lamp Works, Ltd., against the British Tungsten Lamp Co., Ltd., and Another, for infringement of Letters Patent, an order was by consent made on July 26th, 1911, whereby it was (among other things) ordered that the defendants, their servants, agents and workmen be restrained during the continuance of certain Letters Patent from importing into and from making, selling, offering for sale, supplying and using, in this realm, any illuminating bodies or electric lamps containing illuminating bodies made according to, or in manner described and claimed in, the specification of such Letters Patent, or according to or in manner only colourably differing therefrom, and generally from infringing the rights of the plaintiffs under the said Letters Patent, and that the defendants do pay to the plaintiffs the sum agreed for damages sustained by the plaintiffs, or to be sustained by reason of the infringement of the said Letters Patent by the defendants by the manufacture and sale prior to the date thereof of lamps and filaments, and the sale of the lamps then in stock or by reason of the user of such lamps and filaments, and that the defendants do pay to the plaintiffs their costs of the said action to be taxed by the Taxing Master.

Catalogues and Lists.—Messrs. Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.—Leaflet (M III 1) containing an illustrated description of the "Domestic" motor equipment, with continuous-current motor, for driving sewing machines.

The Union Electric Co., Ltd., Park Street, Southwark, S.E.—Small folder giving in a most compact form a table of prices of "Union" D.C. motors; it will fit into an ordinary card-case or vest pocket. A small table of fuse wires is also given. Contractors can obtain these folders on application to the above address. Advance copy of list No. 5,022 (10 pages) containing descriptions, tabulated outputs, speeds, sizes, code-words and prices of Union D.C. interpole dynamos and motors. A large range of sizes is listed, and the machines can be supplied with various mechanical protections to suit different purposes.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Illustrated leaflets showing bare aluminium transmission lines erected for the War Office at Aldershot, and supplied to the Northern Light, Power and Coal Co., Ltd., at Dawson City, Klondyke; also braided aluminium transmission line erected along the sea-coast at Lyme Regis.

Messrs. Tetley & Co., Falcon Electrical Works, Salford.—Illustrated price lists of "Rex" switches, Poland knife switches, battery switches, Bedford and Falcon patent liquid dimmers, fuses and fuse-boxes and other manufactures.

Mr. H. K. Lewis, 136, Gower Street, London, W.C.—July catalogue of new scientific books and new editions added to the circulating library since April last.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—A very full and complete conduit catalogue of 112 pages has just been issued by this firm. It is conveniently and effectively arranged with numerous illustrations accompanied by tables of sizes and prices of Armorduct steel conduit, conduit accessories, distribution boards, switchgear, also mill and ship fittings. A number of new fittings are included, and to these we draw attention in our "New Devices" section to-day. The preparation of the catalogue has naturally involved a great deal of labour and expense; no doubt many of our readers interested in this class of installation work will desire to have a copy amongst their collection.

The India-Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon Street, London, E.C.—16-page brochure giving clearly tabulated prices of their Silvertown Leclanché batteries, medical batteries, Bleeck-Love primary batteries, &c.; also a 16-page price list (No. 27) of gutta-percha, india-rubber, silk and cotton-covered wires, jointing tools and materials.

Messrs. Wailes, Dove & Co., Ltd., 5, St. Nicholas Buildings, Newcastle-on-Tyne.—Pamphlet giving particulars of their patent "Bitumastic" enamel, with photographs of electrical and other works, including blast-furnace plant, pipe line, track, &c., for which it has been employed.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—The current weekly mail card illustrates and gives prices of a new line of extra-heavy and medium-heavy English-made lampholders now being introduced by the firm.

Russia.—Electricity Works Statistics.—The Russian *Official Messenger* of July 18th publishes a list which has been drawn up by the Ministry of Finance, showing the towns throughout Russia possessing electric generating stations and gasworks. The article includes a list of stations in existence of different capacities, stations which have been established since the date of the inquiry, and also general and statistical information on the recent developments in the electrical industries of Russia. The *Messenger*, containing further particulars (in Russian), may be seen by British electrical firms at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Economy in the Power Station.—We are informed that at the meeting of the Mersey Railway Co., Mr. J. Falconer, the chairman, in reply to a question, stated that the Tirrill regulator recently installed, was affecting a saving of £500 a year, so that it has abundantly justified itself. We also understand that these regulators, installed in stations where the voltage varied considerably, have kept the voltage constant within 1 per cent.

Brazil.—£60,000 is to be spent by the Manáos Harbour Co. upon floating wharves and a fixed wharf with electric hoists at Manáos.

Bankruptcy Proceedings.—William Tully, mica merchant, lately trading at 16, Water Lane, Great Tower Street, E.C., as Tully & Straker.—This public examination was held on Tuesday at the London Bankruptcy Court. The statement of affairs showed total liabilities £535 (unsecured £466), and assets valued at £44, absorbed in the preferential claims. Replying to Mr. Walter Bayle, Assistant Official Receiver, the debtor stated that in 1890 he became superintendent engineer to a firm of London shipowners and brokers, and whilst in their employ he commenced for them the business of mica merchants, of which article he had made a study and become an expert in. Mica was largely used for the manufacture of lightning arresters for telephones. In 1899 witness and another person commenced business in partnership as mica merchants at Water Lane, under the style of Tully & Straker. The partner withdrew his capital in November, 1909, and subsequently witness continued the business alone, but, owing to lack of capital, he did not make sufficient profit to pay expenses. He gradually got into debt, and in March last a creditor, having obtained judgment and levied execution at his private residence, witness filed his petition. He attributed his failure and insolvency to loss on trading and want of capital. The examination was concluded.

Frederick Vickers (Fredk. Vickers & Co.), electrical engineer, 286, Oxford Road, Manchester.—Receiving order granted August 9th, on debtor's petition. First meeting August 23rd; public examination, August 25th, both at Manchester.

C. H. Pearson, electrical engineer, decorator and plumber, &c., Greenheys, Manchester (Pearson & Co., and the B.Q.A. Engineering Co.).—First dividend of 3s. 4d. in the £; payable August 18th, at 27, Brazennose Street, Manchester.

Dissolutions and Liquidations.—Alliance Electrical Co., Ltd.—A meeting is to be held at 23, Grafton Street, W., on September 12th, to hear at account of the winding up from the liquidator, Mr. H. V. Marriott. The company was wound up for the sale of its undertaking and assets to the Alliance Electrical Stores, Ltd.

Lepel Wireless Syndicate, Ltd.—A meeting is to be held at the Cecil Chambers, West Strand, on September 15th, to hear an account of the winding up from the liquidator, Mr. A. Holt.

Rosario Electric Co., Ltd.—A similar meeting of this company is called for September 12th at 52, Moorgate Street, E.C. Liquidator, Mr. H. E. Benthall.

Telegraphic Code Co., Ltd.—A similar meeting in this case is called for September 12th, at 318, Moorgate Station Chambers, E.C. Liquidator, Mr. A. W. Good.

Messrs. W. C. C. Hawtayne and G. A. Zeden, carrying on business as consulting engineers at 9, Queen Street Place, E.C., as Hawtayne & Zeden, have dissolved partnership by mutual consent as and from June 30th, 1911. Mr. William Charles Cloete Hawtayne will attend to debts and continue the business in his own name.

Trade Announcements.—The London and Rugby Engineering Co., Ltd., 10, Bush Lane, Cannon Street, London, E.C., have acquired the business of Messrs. J. L Cateaux & Co., including all assets and liabilities as from July 1st, 1911. Any accounts owing by Messrs. Cateaux will be settled by the new company (directors, J. L. Cateaux and E. W. Fraser), as they become due. The company will be managed by the principals of the old firm.

The telephone number of Messrs. Spencer, Chapman and Messel, Ltd., is now "Avenue 1588" (three lines).

The Polystat Electric Co. ask us to announce that all inquiries and orders for "Unica" battery sediment pumps "Duplex" under acid cell inspection lamps, and the gas soldering stoves with self-preducing hydrogen jets, should be addressed to their new offices at 5, Kelvin Avenue, Sale, near Manchester.

Messrs. Richard Pape, Ltd., of Albion House, New Oxford Street, W.C., have now removed their registered offices to Belvedere Works, Belvedere, Kent.

The Armorduct Manufacturing Co., Ltd., have added a third telephone line. Their existing numbers, "400 and 401 Holborn," remain unaltered, and the new number is 6854 under the same Exchange.

Book Notices.—"Le Froid Industriel et ses Applications." Second edition. 1911. Paris: *Mois Scientifique et Industriel*. Price 2 fr. 75.

"Science Abstracts." Vol. 14, Part 7. Sections A and B. July 25th, 1911. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"All About Patents." By C. W. Crossley. 1911. Guildford: Billing & Sons, Ltd. Price 9d. net.

"Year Book of the Michigan College of Mines." 1910-1911. Houghton, Mich.: The College.

"*Journal* of the Franklin Institute." Vol. CLXXII, No. 2. August, 1911. Philadelphia: The Institute. Price 50 cents.

"*Journal* of the American Society of Mechanical Engineers." August, 1911. New York: The Society. Price $1.

For Sale.—The Great Northern Railway Co. (Ireland) has for sale a quantity of electric generating plant, now in position at its Belfast power house. See our advertisement pages in this issue.

LIGHTING and POWER NOTES.

Aldrington.—The Hove T.C. has decided to supply current on a three years' agreement to Mr. Overton, who is establishing a factory in the Aldrington district. The extension will cost £215, and the guaranteed annual return is to be £85.

Australia.—The Waterloo Council (N.S.W.), has decided to sign a contract with the Sydney City Council for lighting the municipality with electricity and providing motive power for the many factories in the district. The City Council will now have in its hands the supply of electric light and power to Botany, North Botany, Alexandria and Waterloo. The other municipality in this division is Redfern, the Council of which has virtually agreed to accept the offer of the City Council to purchase its goodwill.—*Australian Mining Standard.*

Barnsley.—At the last meeting of the T.C. it was stated that preparations had been made for installing electric light in place of the present gas lamps, which would be dispensed with at the close of the year.

Burnley.—The R.D.C. on August 10th decided to consent to the application by Burnley T.C. to the B. of T. for the grant of a provisional order under the Electric Lighting Acts, authorising the supply of electricity within the parish of Reedley Hallows.

Biddulph.—The U.D.C. has provisionally adopted the E.L. scheme submitted by Mr. R. Heath, and referred to in our last issue. It is proposed to carry out the scheme by means of overhead wires, and to supply current at 3½d. per unit with meter rent. A canvass of the district is to be undertaken by the Council, and the B. of T. is to be asked to consent to the use of overhead wires throughout.

Chard.—The T.C. has decided not to entertain the E.L. proposals submitted by Messrs. Purves, of Exeter.

Chesterfield.—The Electrical Committee of the T.C. has recommended that the price of current for lighting shall be reduced by ¼d. per unit to all consumers.

Continental Notes.—Austria.—It is intended to erect a water-power station at Zengg in Croatia, of a capacity of 70,000 H.P. for the supply of lighting and power to the city of Fiume and neighbouring districts, also to the Hungarian State Railway Administration, which purposes electrifying the stretch of line between Fiume and Croatia. The capital expenditure is estimated at about 75,000,000 kronen.—*Elektrotechnische Zeitschrift.*

Belgium.—A somewhat new condition, as regards Belgium, is included in the conditions relating to the concession for the electric lighting undertaking in the town of Mons. It reads that "all the material, machinery, conductors, meters and apparatus employed by the concessionnaire must be manufactured by means of primary materials dealt with in factories in Belgium."

Germany.—The T.C. of Altona, in the Elbe district, has decided to sell outright the electrical undertaking, as it has become insufficient for the town's needs, and there are difficulties, in the present state of the money market, in the way of raising the M. 3,000,000 required for the construction of new works on a fresh site. Offers have accordingly been made from two quarters for its acquisition. The A.E.G. proposes to take back the old works and build an up-to-date new station on the strand at Neumühlen, and to guarantee the return of a *pro rata* portion of the yearly increased receipts to the town authorities. In the second place, the Siemens-Schuckertwerke has made a still more favourable offer. In consequence, the T.C. has nominated a commission to report on the competitive offers, and its decision is expected in October.

An experiment which appears to have been completely successful has just been made in the covered market at Altona with the Moore light. This light, as is well known, is founded on the principle of the Geissler tube. A large concourse of spectators attended to witness its first employment on so large a scale. It took about an hour to create a vacuum in the glass tube, which is about 122 metres long, and to charge it with electricity. The C.P. of the light was 7,500; the consumption of current was about 8·8 KW. per hour, the cost per hour being about 1s. 1d. Ten business firms have, it is said, placed orders for similar installations. The Moore light is also to be installed in the tunnel under the Elbe at Hamburg and in a number of theatres and concert halls at Hamburg and Altona.—*Revue Pratique de l'Electricité.*

From statistics officially prepared for the year 1907, it appears that the electric driving power employed in German industries reached the figure of 1,544,801 KW., while non-electric power of all kinds totalled 8,831,434 H.P. The latter was thus 5·72 times greater than the former. Electric machinery and appliances were employed in 2,905 main and 184 subsidiary industries, out of a grand total of 252,912 main and 18,063 subsidiary industries.—*Elektrotechnik und Maschinenbau.*

Russia.—Promoted by the Imperial Russian Technical Society, an Exhibition is to held at Baku in September, of electric and internal combustion motors and automobiles. Exhibits re-exported within six months will have the duty refunded.

Dublin.—The L.G.B. has sanctioned the borrowing of £100,000 for electricity purposes, including the £50,000 already sanctioned for this purpose recently.

Gravesend.—The Kent Education Committee has decided to have the E.L. installed at the new Technical Schools.

Greenock.—It was reported at the meeting of the T.C. on Tuesday (15th inst.), that the net profits of the electricity department for the year were £5,520. Two years ago the net profits were £1,045; a year ago they were £3,247, and now they had risen to a sum hitherto unrecorded in the history of the department. This was after paying all charges for interest, sinking fund and depreciation. The power output was responsible for the largest part of this increase, but, at the same time, there was an increase of 21 per cent. in lighting, and 13 per cent. for traction. The policy of the Committee had been shown to be a correct one—to attract large power consumers instead of allowing them to set up electric power of their own. They were unanimous in placing £1,500 to the reserve fund, and they had £4,020 as the sum left for allocation, which would be dealt with at the next meeting. It was also pointed out that this was the largest increase recorded in any one financial year, and the department was on a thoroughly sound financial footing. The accounts were approved.

Glasgow.—At the last meeting of the T.C. ex-Bailie Willock (the convener) submitted the annual accounts and reports of the Electricity Committee pointing out that it was pleasant to note that the depression from which the department had suffered during the past three years was now rapidly disappearing. The revenue account showed a substantial increase, and the general cost of work was improved, and after the deduction of depreciation, there had been a net increase over the year of £30,251. The revenue had increased by £14,567, largely derived from power consumers. Notwithstanding that 5,826,000 more units had been generated this year, as compared with last year, the coal bill had only gone up £1,231, and that was wholly due to the extra 9d. per ton paid for coal. As a matter of fact, the saving in coal consumed during the past year was equivalent to about 15,000 tons, equal to a money saving of £6,000. The other items in the cost of generation had fallen $\frac{1}{10}$th of a penny per unit sold, or a total saving of £2,500. There had been slight unavoidable increases in the cost of distribution, but the average price received during the year had been just over 1½d. per unit, and the cost of production just under 1½d. per unit. The difference between the two was a surplus of £6,680, which the Committee was empowered to place to the reserve fund, as the sum was not sufficient to permit an effective reduction to any class of consumer. It was confidently anticipated that next year a reduction affecting some section of consumers would be possible. Bailie W. F. Russell, the convener of the Tramways Committee, suggested that the time had now arrived when there should be some amalgamation of his department with that of the electricity department. The report and accounts were approved.

On the evening of Friday, 11th inst., Lady M'Innes Shaw, the wife of the Lord Provost of the City, inaugurated the scheme of electrical illumination at the Scottish National Exhibition at Glasgow. The scheme covers practically the whole Exhibition area; in all about 50,000 incandescent lamps have been used.

Grimsby.—The borough electrical engineer is to report to his Committee upon a proposal to reduce the charge for electricity to private consumers from 3½d. to 3¼d. per unit.

Hessle.—The U.D.C. on Monday decided that at the earliest possible date the Council should proceed to put into execution the powers of the E.L. order, 1905, and that plans, specifications, &c., for the laying of mains and the equipment of the transformer stations be prepared; providing satisfactory terms can be obtained, current in bulk will be taken from Hull T.C., but the control of the distribution and supply within the district will be retained by the U.D.C.

Heywood.—At the quarterly meeting of the T.C. last week, it was decided to apply for borrowing powers for £3,000 for the electricity and tramway services.

Irvine (N.B.).—The Harbour Trust has unanimously agreed to appoint a qualified engineer to report on the probable cost of electric lighting at the harbour and its adoption for power purposes.

Japan.—The municipal authorities of Yokosuka have passed a resolution in favour of municipalising the undertaking of the Yokosuka Electric Light Co., and are negotiating with the company with regard to the purchase.

Kirkheaton.—The D.C. has placed the contract for the lighting of the central portion of the district by electricity for a period of five years with Mr. T. W. Broadbent.

Liverpool.—On July 16th at All Saints' Church the inauguration of the new electric lighting installation took place. The work was carried out by the Northern Electrical and Ventilating Co., Ltd., of Liverpool. The already existing artistic gas pendant fittings were utilised.

London.—Islington.—The Lighting Committee reported at the last meeting of the Council having informed the Finance Committee that it was prepared to agree that the price of electricity supplied for public lighting should be reduced by £1,000, and that a similar sum should be applied to the relief of the general rate. In the course of the discussion, Alderman Vorley said that owing to the assessment having been increased, they had now to pay £900 a year extra in rates. The charge for public lighting, he said, was now 1·67d.; the average for all London was 1·63d., while outside London it was 2·05d. The price was slightly below cost, but the cost was falling. It was true that in the early years of the undertaking the Committee had overcharged for public lighting. While the Council had paid them £18,000 more than cost price, the Committee had also supplied the Council with electricity under cost to the amount of £12,000, so that the Council had paid a sum of £6,000 in 15 years above actual cost, without making a charge for depreciation. After the summer vacation he intended to bring up a scheme of development.

Newport.—The future of the electricity and tramways undertaking was under discussion by the T.C. last week, when a proposal to appoint a commercial manager was withdrawn in favour of a motion to obtain a report from the Electricity and Tramways Committee on the position and administration of the undertaking, and as to what changes, if any, were necessary in its control and management, which was carried by 21 votes to 1. The manager, Mr. Collings Bishop, was away at the time, and this fact was mentioned by one speaker. A further discussion took place in regard to the recent resignation of Mr. Ellis, the secretary of the department.

Radcliffe.—At a meeting of the D.C. held on Monday, it was announced that the Lancashire Electric Power Co., which has its generating station in the district, is applying for a provisional order to supply electricity in the urban district.

Sheffield.—The Electric Light Committee of the City Council has recommended that, in view of the large and continually increasing demand for electricity, application be made to the L.G.B. for sanction to borrow a further sum of £61,099, in connection with the Neepsend generating station extension. This £61,099 is part of the sum of £250,000 provisionally approved by the Consultative Committee on July 1st, 1908, for the report of the special committee of inquiry.

Southport.—The Electricity and Tramways Committee of the T.C. having decided that it is desirable that a system of electric clocks should be established in the borough, a report is being prepared as to the best system to adopt.

South Africa.—The Johannesburg (Transvaal) Municipal Electric Supply is making continuous progress, the output for June last (1,693,364 units) comparing with 886,177 units in June, 1908. The present generating plant includes two 3,000-KW. Belliss-Lahmeyer turbo-alternators and a 1,000-KW. Belliss engine-driven alternator, also two 1,000-KW. and two 500-KW. Belliss D.C. sets and 1,750 KW. of motor-converting plant. The boiler house equipment includes 14 Babcock boilers and a Bettington dust-fuel boiler, and new coal-conveying plant and bunkers are to be provided at an estimated cost of £14,000. The town supply is on the direct-current three-wire system (460-230 volts), while the suburban area is supplied with 3,300-volt 50-cycle single-phase current, reduced at transformer stations to 200 volts pressure for consumers' use.

Stourport.—The U.D.C. has referred to a Special Committee a scheme for E.L. submitted by the Kidderminster E.L. Co. The use of overhead mains is suggested.

Walsall.—The assistant electrical engineer has been instructed to make good the damage caused by the recent fire at the Butts Road sub-station by altering the existing switchboards so as to bring them more up to date, at an estimated cost of £125. A coal elevator is to be provided for the new boiler at an estimated cost of £120. The tramway manager has been instructed to have one of the cars fitted with speed indicators, and to arrange for each motorman in turn to handle the car so as to provide some training in the judgment of various speeds.

Whitehaven.—At a meeting of the T.C. on August 10th, Mr. Graham drew attention to a charge of £56 for installing 20 electric lamps at the Hospital, and said that it was time that they should admit outside competition for wiring work, as local firms seemed "to put their heads together to keep up the price." The Corporation had four times as much power as they were supplying, and three-fifths of the ratepayers would take the E.L. if the cost of installations were not so great. Mr. Walker replied that he went through the tenders, and the highest was about double the lowest one. If Mr. Graham had seen the great disparity in the tenders he would not have thought there was any collusion on the part of local tradesmen. The Hospital was a difficult place to wire.

TRAMWAY and RAILWAY NOTES.

Ashton.—The tramway workers in the area have placed their demands for an increase of wages and alteration of working conditions before the local authorities. The T.C. is awaiting the report of a joint conference before taking action.

Australia.—Among the public works which have been sanctioned by the N.S.W. Legislature is the construction of an electric tramway from Darley Road, Randwick, to Little Coogee at a cost of £81,763.

The power house of the Adelaide Municipal Tramways Trusts at Port Adelaide, was officially opened by the State Premier recently. Energy is generated at 11,000 volts, and transmitted by duplicate overhead lines to converter sub-stations about 10 mile, away. The power house site is adjacent to the river, and gives ample water and coaling facilities.

(*Continued on page 263.*)

THE SWISS TOUR OF THE INSTITUTION OF MECHANICAL ENGINEERS.—II.

BY OUR SPECIAL COMMISSIONER.

In our first article we published four photographic views (figs. 4-7) illustrating the results of a curious accident to a water turbine, which, as occurring in a kind of machinery we English are not familiar with, may have special interest to our readers. The turbine was a vertical-shaft Francis machine. Every part was well and properly made, and all parts erected properly to specification. There was no weakness, accidental or otherwise, of material or of dimensions any where. The top "umbrella" cover of the turbine was bolted down with the proper number of bolts of the proper size. The nut of one of these bolts, however, was not tightened up so hard as it ought to have been, and apparently was not cottared. In starting to run all went well at low speed, but when the speed became high the vibration caused this nut to slack back. The bolt eventually got loose. It was sucked into the runner blades, while the nut was similarly carried by the water through the gates, guide blades and runners. The high rotary and centrifugal velocity drove these through the blades with such violence as to break and practically to strip the blades over the whole circumference of the wheel. The views show the result. In consequence, the whole had to be dismounted, and a new runner wheel and a new set of guide blades had to be supplied.

The first afternoon excursion took us to Neuhausen and Schaffhausen, to visit the hydro-electric plant there. After visiting these works we went to view the Rhine Falls, a mile or two lower down the river, and then joined the ladies at dinner in the Schweizerhof, which has a magnificent view of those wonderfully beautiful falls, returning to Zürich by train in the late evening. Fig. 1 shows a plan of the water-works, which in their new development, not yet wholly complete, present in one respect uniquely interesting features.

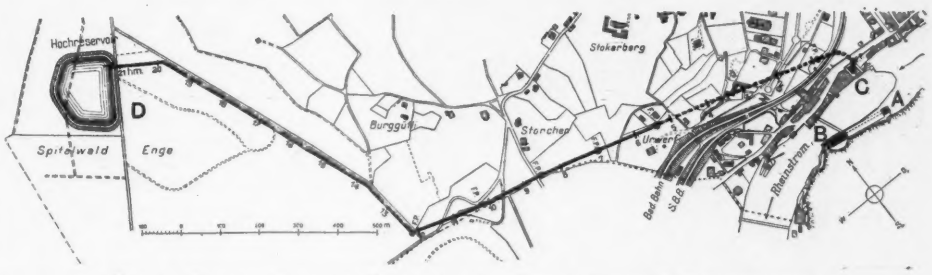


Fig. 1.—Plan of Storage Works and Stations A, B and C, Schaffhausen.

Fig. 2.—Part of the Pipe Line, Schaffhausen.

Historically these are the oldest water-works of large size in Switzerland. The original power house, still in use, was placed in the position marked A on the plan; and the power was transmitted by ropes across the river to its north side. Twenty years ago the station B was built, and electric generation was commenced, but ropes from turbine to dynamo were used to obtain the necessary rotary speed in the latter. Since 1906 the works have been completely remodelled. The head and tail races at station B have been rebuilt, so as to allow of much fuller utilisation of the available water flow and head. It is designed for a fall varying from 3½ to 5½ m. with a flow in cb. m. per sec. ranging from 14·2 with the low head to 8·1 with the high head. The maximum horse-power per turbine is 520 with the maximum flow and minimum head, and ranges down to 450, the speed being 75 R.P.M. There are five of these turbines, built by Thomas Bell & Co., of Kriens, at station B, all Francis wheels on vertical shafts with 80-pole 505 K.V.A. three-phase Oerlikon generators set direct on top of the shaft. The periodicity is 50, and the voltage 2,100. Fig. 10 is a section of this turbine and generator, the former having double runners. The draught tube of the top runner is in the form of an inverted siphon, to which is applied a small air suction pump to produce vacuum at starting. It has, however, been found unnecessary to use this air pump except at the first start. The rotor of the generator weighs 26 tons.

The night load is very light, but the Rhine does not cease to flow overnight; and near the works there is no possible water storage. For this reason the new works at the positions C and D on the plan were designed, and are now at work, although their full development upon double their present working scale will come later. Fig. 4 is a view of

part of the power house at C. In the middle of the shaft of each unit is keyed a motor-generator alternately used as motor and as generator. At one end of the shaft is an Escher, Wyss high-pressure turbine; and at the other end a Sulzer 2-stage centrifugal pump. During the night the motor receives electrical energy from station B on the south side of the river and drives the centrifugal pumps, which deliver water to a high-level reservoir situated at D, 2·1 km.

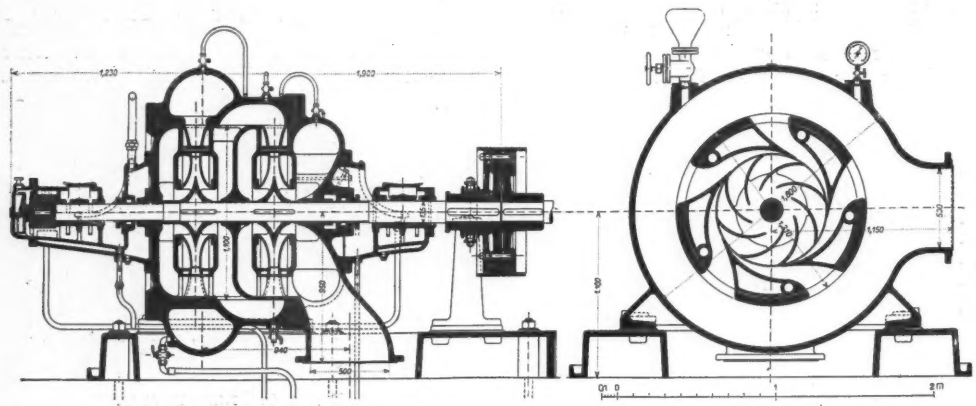


FIG. 3.—SULZER TWO-STAGE CENTRIFUGAL PUMPS, STATION C.

distant. During the times of peak load in the day time, water flows back from this reservoir and drives the turbines, which again drive the generators and thus supply electric energy to the transmission network.

The overflow level of the reservoir is 155 m. above the pumps. In the flow of the water through this long pipe a head of 30 m. is spent in overcoming friction; so that this item alone brings the efficiency down to $(155 - 30)/(155 + 30) = 125/185 = 67\frac{1}{2}$ per cent. Besides this, there are the other items of inefficiency: (2) mechanical and electric loss from generator at B to motor at C; (3) mechanical loss in pumps at C; (4) mechanical loss in turbines at C; and (5) mechanical and electric loss in generator at C. In these are, of course, included the frictional losses at the bearings of the shafts. The result is that the overall efficiency is no more than 42 per cent.

Each unit is of about 1,000 H.P. The motor-generators are of Brown, Boveri manufacture with 2,150 volts and 25 per cent. half-hour overload capacity, the normal being 1,000 K.V.A., with $\cos\phi = 0{\cdot}7$ and a speed of 1,000 R.P.M. Fig. 5 is a section of this machine. When warm the insulation will stand 5,000 volts A.C. between the iron and the armature copper. Each pole has 100 windings of 1·4 by 35 mm. cross-section copper strip with 0·2 mm. thickness of paper insulation; and there are three pairs of poles. In the high-tension winding the copper section is 16 by 17 mm. cross-section, and the insulation is 2 mm. thick.

Fig. 3 gives two sections of the two-stage Sulzer centrifugal pumps. They are designed to deliver 350 litres per second per pump, and are of 980 H.P. at 1,000 R.P.M. The efficiency is 78 per cent. There is also a six-stage pump of small size for the special duty of filling the pipe when it has been emptied for cleaning or repair.

Fig. 6 is a section and plan of the Francis turbine, built by Escher, Wyss & Co., for a fall of 157 m. and 1,000 R.P.M. It has a spiral casing, and a duplex balanced runner with two symmetrical draught tubes uniting in one underneath the floor. The two branches are connected by a cross-pipe to ensure equality in the vacuums on the two sides. The runners are of gun-metal throughout, and have open tipped blades. The interior surfaces of the casing opposed to these blade tips are carefully ground smooth and to exact form for a close fit. The efficiency ranges from 74 to 78 per cent. at half and full gates.

Figs. 7 and 8 show two parts of the pipe line laid in open trench and in tunnel. The trench is filled in with loose soil for protection from frost. Near the reservoir the gradient varies from 3 to 30 per 1,000; there is then a stretch of nearly $\frac{1}{2}$ km. long at an average of nearly 240 per 1,000, the rest being sloped to a mean of less than 100 per 1,000. A $\frac{1}{2}$ km. length is taken through tunnel in hard rock. Near the reservoir the diameter of the pipe is 1 m.; but it is gradually decreased to 800 mm. at the power house.

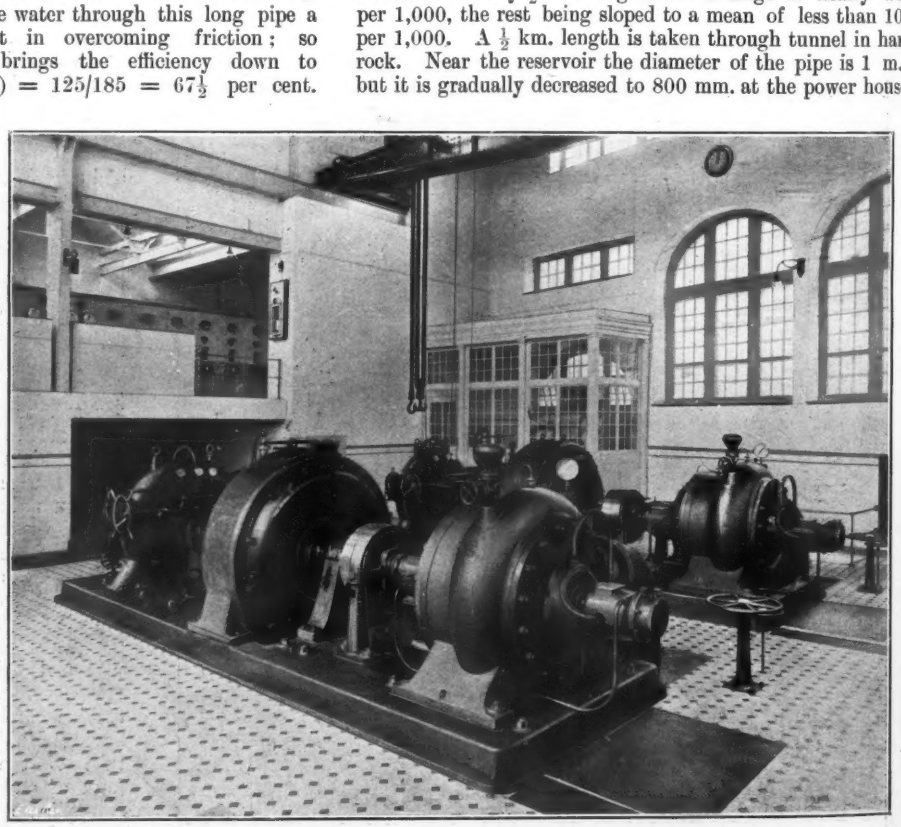


FIG. 4.—MOTOR-GENERATOR, TURBINE AND PUMP SETS, STATION C, SCHAFFHAUSEN.

The proper anchoring of the pipe to the rock in the tunnel and to concrete foundation beds in the trench, and the provision for temperature expansion between these anchorages are matters requiring very careful attention, but not offering any great difficulty. Fig. 2 is a pleasant bird's-eye view of part of the pipe line through the higher part of its reach.

The reservoir was formed by excavation on the site of an

old swamp. It has a water surface of 20,000 sq. m., and a mean depth of 5 m., giving a storage capacity of 70,000 cb. m.

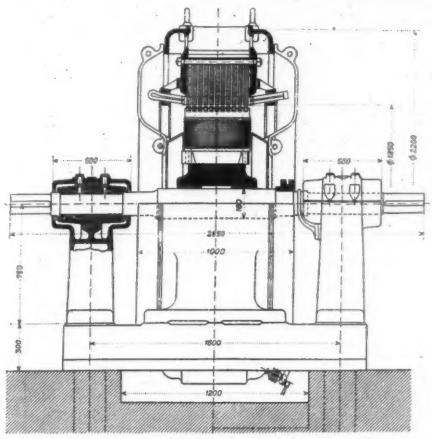


Fig. 5.—Brown, Boveri 1,000-h.p. Motor-Generator at Station C.

Fig. 9 is a diagram bringing together all the useful results of this plant upon a base-line of water flow, the bottom scale being litres per second per unit plant.

A duplication of this storage plant is contemplated in the near future. The reservoir will have its embankments raised by ½ m., increasing the storage capacity to 80,000 cb. m.; and a second pipe line of the same size will be laid. The tunnel through the rock has been cut to take two pipes, and the various concrete anchorages have been built for two pipes. The power house has, of course, also been built to allow of this future extension of plant. The large capital outlay involved in this storage plant with its long expensive pipe line makes it of special interest; and many of our party wondered where the dividend-earning power came in. Such outlay would not be justified for the purpose in view, except in a country where native coal does not exist. The whole coal supply of the country comes chiefly from England and Westphalia, and, in smaller proportion, from France.

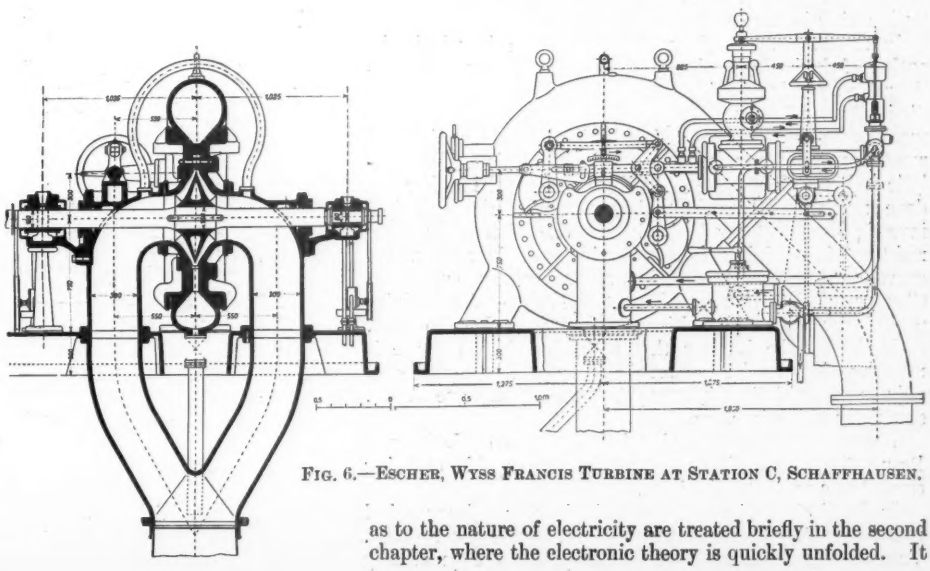


Fig. 6.—Escher, Wyss Francis Turbine at Station C, Schaffhausen.

REVIEWS.

Principles of Wireless Telegraphy. By G. W. Pierce, A.M., Ph.D. 1910. London: Hill Publishing Co. Price 12s. 6d.

It is now possible to form a small library consisting of works on wireless telegraphy and literature relating thereto. The appearance of books by well-known investigators can, however, still be welcomed, and that forming the subject of this review may undoubtedly be included in the category. The work covers some 342 pages, with 28 chapters and appendix and abundant illustrations.

While touching upon the theory of electrical principles in general, and of electrical oscillations in particular, the author avoids the introduction of the more recondite mathematical investigations of the subject, and presents it in a popular manner. With the exception of Chapter II, the theoretical treatment is explicit and specially suited to lead up to the consideration of wireless telegraphy phenomena. Theories as to the nature of electricity are treated briefly in the second chapter, where the electronic theory is quickly unfolded. It

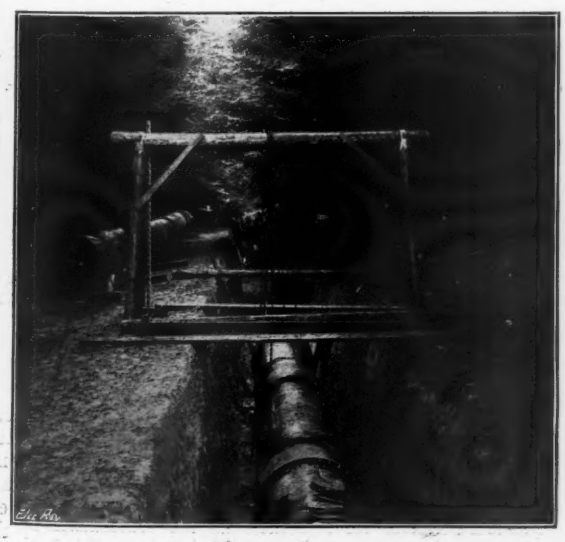


Fig. 7.—Pipe Line in Open Trench.

Fig. 8.—Pipe Line in Rock Tunnel.

yet remains to be seen in what respect the electronic theory in its present crude and somewhat unhealthy development can assist the student in forming accurate conceptions of the operations involved in electromagnetic phenomena in general and wireless telegraphy effects in particular. That it will confuse and bewilder him is much more likely. Serious exception may, for instance, be taken to the idea expressed

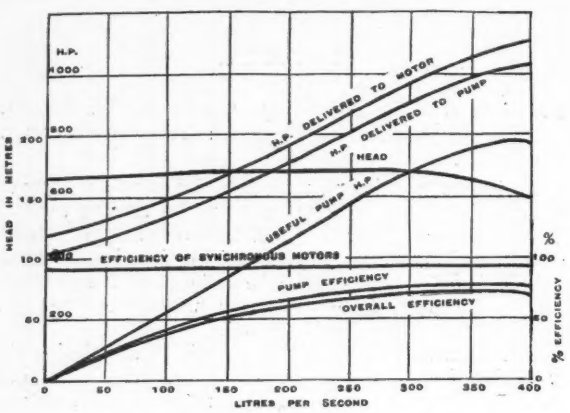


Fig. 9.—Efficiency Curves, Station C.

in Chapter II that the Leyden jar discharge may be pictured as a flow of negatively charged corpuscles from one coating to the other with periodic reversals of the direction of flow. Such a view is quite controversial.

In matters of experimental investigation in which the author of the book has been concerned and to which considerable attention is given, the information afforded is of a distinctly useful and helpful character. This applies specially to explanations and investigations of coupling and resonance questions as well as to obscure actions of electrolytic and crystal detectors. In these matters the author has done much useful work, and a *résumé* of the principal investigations and results is given. The effect of damping resistance in receiving systems is illustrated in some useful curves on page 226, whilst the selectivity curves in Chapter XXIV give a good idea of the degree of selectivity possible under stated conditions. The author has, however, omitted to make it clear that a considerable allowance is necessary in practice to provide for working margins of adjustment, variations in strength of radiation, wave length, sensibility of receiver, &c.

The comments on the early wireless patents of Lodge and Braun form suggestive reading, but are capable of being carried to a more definite issue.

In descriptions of apparatus and plant used for practical radiotelegraphy there is scope for much greater detail. Transmitters operated from power plants are practically untouched.

From the student's point of view the book may be classed as one of the most useful productions dealing with the subject which has yet appeared.

The Principles of Electric Wave Telegraphy and Telephony. By J. A. Fleming, M.A., D.Sc., F.R.S. Second edition. 1910. London: Longmans, Green & Co. Price 28s.

As indicated in the preface to the second edition of this well-known work, considerable revision and extension has been made, the title having also been amplified to include the subject of radiotelephony. The book now runs into some 906 pages as compared with 671 in the original edition.

The individual chapters have been revised and rearranged, many of them being considerably extended. Among the more important additions may be mentioned descriptions of the Gehrcke vacuum oscillograph tube—a handy and useful appliance for investigating high-tension current changes—the Poulsen arc system, Lepel and quenched spark dischargers, directive systems, including an account of the Bellini-Tosi method, descriptions of some of the more modern radiotelegraph stations and modern practical forms of tuning apparatus such as the Marconi multiple tuner. Attention is also given to developments in the way of measuring appliances and methods specially suited to the requirements of radiotelegraphy. In this direction, however, the last word has by no means yet been said. Several of the methods described and devices illustrated can hardly be termed exact in character. The concluding chapter (Chapter X) deals with the subject of radiotelephony so far as it has yet advanced. Mention is made of a number of devices for which very sanguine claims have been made by various inventors, but which have almost invariably been found to fall short of practical requirements. In one or more of the arrangements described, certain old ideas which were long ago found futile for ordinary telephony are brought out in a new garb. The present state of development of radiotelephony appears to be about summed up in the final paragraph of the chapter. The difficulties encountered have been greater than sanguine investigators had expected, and early promises have not been realised.

Some want of consistency is revealed in the diagrams in respect of the representation of inductance spirals. The zig-zag representation is more frequently adopted than the helical. It is suggested that the former is more appropriate for the representation of resistance.

The author still appears to perpetuate the idea (on pages 360 and 361) that in a true wave propagation the energy in each portion of the medium alternates between the kinetic and potential states, despite the statement also made that the total energy of a wave at any moment is half kinetic and half potential. Though these statements are not necessarily contradictory, the latter ought certainly to be amplified to make the author's meaning clear. We have been taught that Stokes has shown that for waves of light the potential and kinetic energies in the wave are equal and in phase with one another; also that the

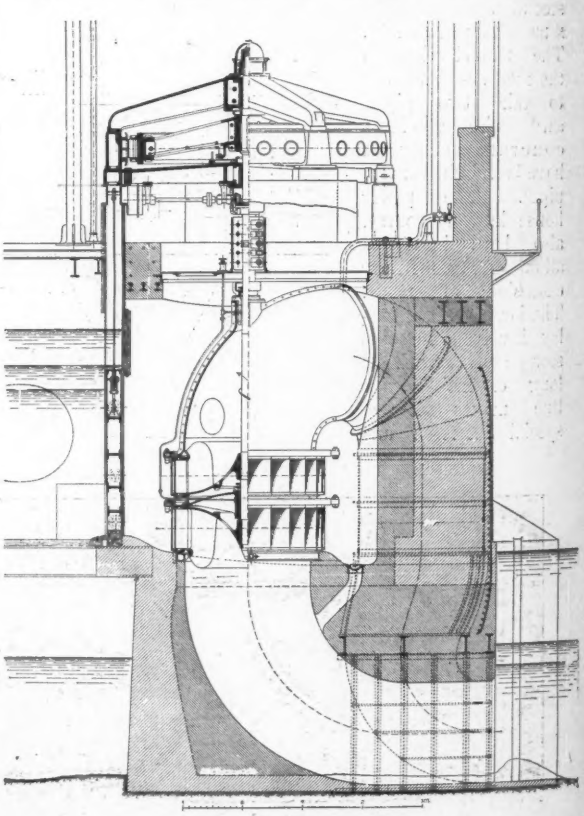


Fig. 10.—Turbine and Generator at Schaffhausen, Station B.

same thing is implied by Maxwell for all electromagnetic waves. A difference of phase would imply reactance of the medium, and a continuous reflection of some portion of the energy back upon the source. In a homogeneous medium this does not occur. No reflection is experienced unless some change in the constitution of the medium is encountered.

Town Scavenging and Refuse Disposal. By Hugh S. Watson. London: St. Bride's Press, Ltd.

This useful little treatise, which is a reprint of articles originally published in the United States, commences by drawing attention to the enormous importance of dealing with town refuse in a proper and sanitary manner.

The statement quoted from Dr. Germans as to the propagation of disease by dust, is in itself sufficient to show that the prompt and efficient sterilisation of all such matter is a necessity to the public health, and demonstrates that the absolute prohibition of any accumulation of refuse either by private persons or public bodies would be perfectly justified.

The carrying of disease germs by flies is not referred to, but the enormous importance of this view of the refuse question has recently been brought out by the researches of Dr. Simpson, of the School of Tropical Medicine, and others, and by various authorities who have lately reported to the Local Government Board on the subject.

Street cleansing is fully dealt with, and in connection with street watering, reference is made to the electrolytic production of a cheap and powerful disinfectant at Poplar under the supervision of Dr. Alexander, Medical Officer of Health of that borough. As the electricity at Poplar is in large part generated by power from the refuse destructor, this is a good example of the art of "making one hand wash the other."

The sanding of roads is referred to, and the use of clinker for this purpose is condemned out and out, on the ground that the clinker disintegrates too easily and forms dust.

With this we do not at all agree. At the present time Leeds and Bradford are saving large sums annually by utilising clinker in this way. The clinker is ground to the size of about $\frac{1}{8}$ in., and the fine dust sifted out of it and rejected. The granular material so produced is used not only for sanding slippery streets, but also for the tramway sandboxes where it replaces sand, which is always very costly, owing to the necessity of careful drying—in itself an expensive operation. Tramway and railway engineers might well weigh the possibility of using this cheap and useful substitute for carefully dried sand. The subject is mentioned again later on in the book, where it is stated that clinker prepared for this purpose realises at Leeds 2s. per cb. yard, and yields a large profit.

Waste paper, house refuse, trade refuse and street refuse are all discussed, and various methods of disposal are reviewed.

The leading destructor types are referred to in detail.

The costs of burning cited vary, as usual, so enormously as to destroy all confidence in the figures. It is (for instance) stated that in the Heenan & Froude destructor the cost of burning is 7·3d. per ton, or, with flue cleaning added, 7·8d. per ton; whereas the cost of burning at Shoreditch, in the Manlove destructor, is given at 3s. 8½d. per ton. It is perfectly obvious that the first figure excludes management clerks, auxiliary labour, repairs, depreciation and capital charges, and therefore bears no comparison whatever with the second figure, which appears to be official and inclusive. This loose handling of important figures seems to be characteristic of the subject, for we can hardly recall an instance in which reliable and comparable figures of cost have been made public. An interesting plate shows the design of the Horsfall automatically-charged destructor on the "Tub-feed" system, but no costs of working are given in this case.

There is a chapter on the utilisation of the waste heat. It is stated that at Liverpool 30 to 40 tramcars are driven 100 miles daily by steam from refuse, which is valued at 1s. 2d. per ton of material consumed.

At Hackney there is a credit for steam of £2,288 per annum, the net inclusive cost of destruction, after allowing for this credit, being 2s. 11½d. per ton. At Preston the power is used for driving the electric tramways. Five hundred H.P. is raised in the Fulham combined station from the refuse; and about 1,000 H.P. is produced and used at Bradford.

While welcoming this useful little compilation, we are bound to admit that a scientific and comprehensive work embodying the practice of to-day in connection with this increasingly important subject has yet to appear.

TRAMWAY and RAILWAY NOTES.

(*Continued from page* 258.)

Bath.—The management of the Bath Electric Tramways on Monday dismissed, on the men's demand, an official who had lately been re-engaged. The men had decided to leave work unless the demand was complied with.

B.E.T. Tramways.—The workmen in the employ of the British Electric Traction Co. engaged on the tramways on the Cradley Heath, Blackheath, Stourbridge, Brierley Hill and Dudley districts have, without solicitation, had their wages increased by ¼d. per hour, equivalent to 1s. 3d. per week. Needless to say, the workmen are greatly elated, particularly as the cost of living has recently increased.

Brierley Hill.—At the meeting of the U.D.C. on Monday, the Tramways Committee reported that a letter had been received from the B. of T., notifying that the latter had granted an extension of the time for the completion of the lines authorised by the Light Railway Order until December 15th next.

Brazil.—According to a private dispatch received in Hamburg, the engineer, Raoul Ribeiro, has applied to the Brazilian Government for a concession to build an electric railway from Rio de Janeiro to Santos. The gauge is to be 1·40 metres, and it is intended to make a junction with the existing Sao Paulo Railway at Santos, whereby the journey from Rio to Sao Paulo will be shortened from 12 to 6 hours. No Government subvention or guarantee is asked for.—*Zeitschr. für Elek. und Masch.*

Chile.—A decree, dated May 31st, has been issued by the Ministry of the Interior approving the plans submitted by Messrs. Cárlos Correa Larrain & Juan Gross for the installation of an electric tramway service and an electric light and power station in the communal district of Barrancas. Work must be commenced within six months and completed within one year from the date of the decree.

A similar decree, dated May 31st, has been issued, approving the plans submitted by Don Renato Saez Ruiz for the construction of an electric tramway in Vina del Mar. In this case also work must be commenced within six months and completed within one year from the date of the decree.

Continental Notes.—Hungary.—According to official figures there were in Hungary, at the end of 1909, five electric tramway systems, having an aggregate extent of 54¾ km., being an increase of 11 km. on the figures of the previous year. The capital city, Buda-Pesth, stands for half of the working track, and employs five of the electric locomotives and 22 of the electric cars running, the balance of six locomotives and 13 cars falling to the other three lines. The rest of the rolling stock consists of 45 passenger and 31 goods carriages. In the course of the year a total of 8,834,952 passengers were carried by the five systems. The capital of 13,000,000 kronen invested in these undertakings yielded in 1909 on the actual capital employed, interest at the rate of 1·16 to 7·87 per cent., the two Buda-Pesth systems earning the highest amounts, or 7·87 and 4·20 per cent. respectively. —*Elektrotechnik und Maschinenbau.*

France.—A new company has lately been formed in Paris, with a capital of £48,000 and the title La Société des Tramways Electriques de Loir-et-Cher, to acquire concessions for, and to construct electric tramways in, the French Department of that name.

Turkey.—The plans for the electrification of the tramways of Constantinople, prepared by the Société des Tramways de Constantinople, involve an estimated expenditure of £T400,000.—*Elektrotechnische Zeitschrift.*

Russia.—The T.C. of Winniza has decided to construct an electric tramway system, and in the towns of Kamenez-Podolsk and Mohlen-Podolsk an electric lighting service will be installed.—*Zeitschr. für Elek. und Masch.*

La Société des Tramways et Eclairage Electriques de Simferopol is the name of a new company which has just been formed in Brussels, with a capital of £140,000, to acquire and work a concession for the construction and operation of a system of electric tramways and for the supply of electrical energy for lighting and power purposes in the town of Simferopol, in the Crimea.

Italy.—The Società Elettriche di Brescia having purchased in 1907 the whole tramway network of the province of Brescia, has electrified a portion, viz., two important suburban lines having a heavy local traffic, and the line connecting the city of Brescia with Lake Garda and its Riviera. The problem of the electrification of these lines presented several difficulties, which have been successfully surmounted by adopting continuous-current at a pressure of 1,200 volts. To secure uniformity in the electrical material, it was decided to employ two motors on the suburban cars and four motors on the Lake Garda cars, the motors being of the same pattern in all cases. The four-motor equipment (supplied by the General Electric Co.), with Sprague multiple control, consists of motors permanently coupled two and two in series, so that the voltage at the terminals of each motor never exceeds 600 volts. The motors are of 50 H.P. capacity, and give a maximum speed of 40 km. per hour. The coach lighting current and that working the pneumatic brake is supplied by a little converter fixed

under the vehicle, which steps down the current from 1,200 to 600 volts. The cars for the suburban service are four-wheeled, and the two motors are permanently coupled in series, control being effected wholly by resistances. The sub-stations, one of which is situated at Brescia and the other at Salo, on the western bank of Lake Garda, are each equipped with two sets of rotary converters with a regulating battery. The overhead line, constructed by the Italian Thomson-Houston Co., is of the catenary suspension type, supported at four points by trellis-work posts placed at distances of 60 metres apart. The electrification took place without the least interruption of the previously-existing steam service, and the working of the electric service, with double the number of trains, was introduced from day to day without the least inconvenience.

Dewsbury.—The T.C. has under consideration the construction of a tramway from the Market Place to Dewsbury Moor, the latter being the only district in the borough for which there is not a service provided, with the exception of the Leeds Road route to Shawcross, for which a Bill is before Parliament. The Secretary to the Yorkshire (Woollen District) Electric Tramways, Ltd., has written to the Corporation stating that the company is not prepared to obtain powers to construct a tramway to Dewsbury Moor in compliance with notice served by the Corporation over six months ago. The company suggests that if the railless trolley system would be acceptable to the Corporation, it will be prepared to consider the matter further. The question has been referred to a Joint Committee of the Parliamentary, Electricity and Tramways Committees, the members of which have inspected the service of railless trolley cars running between Leeds and Farnley.

Dundee.—The Corporation Tramway Committee has resolved to adopt the railless trolley system on the Clepington Road, forming a connection with the Maryfield and Downfield systems. Mr. A. Spence, the tramway convener, said it would be some time before the system was in operation because of the time required to get the overhead equipment and cars ready. Bailie Don pointed out that the tramway department would be charged with a portion of the cost of remaking the road. The convener replied that if the department had to pay anything towards the maintenance of the road, then the system could not go in. They did not want a specially macadamised road as the cars could run on any road. Treasurer Soutar suggested that the tramway department should contribute £100 a year towards the upkeep of the road, but the convener retorted that they had no power to contribute towards the upkeep of the roads unless they laid rails. Ultimately it was decided that the system should be proceeded with, and that the question of the road should be deferred meantime.

Glasgow.—The city and suburbs have just weathered one of the most sharp, though short, labour struggles which has ever been experienced. As reported in the REVIEW lately, the Corporation approved of the action of the tramways department in refusing to grant an application by the motormen and conductors for a working week of 48 hours and a 14 days' annual holiday with pay. Later, the T.C. granted the discontents an increase of 1s. per week in the case of all men with over two years' service; but while this appeared acceptable for a time, the employés' leaders came forward in a subsequent request for a 51-hours' week, a seven days' holiday with pay, and an all-round increase of 1s. per week. The matter was remitted to the Tramways Committee for reconsideration, but without waiting for the report of that body the men belonging to the Municipal Employés' Association, and forming the bulk of the service, decided to strike work on Saturday morning. This action for a time paralysed the service, though the men who had not come out, and were conveyed to the depôts in motor cars and under police escort, managed to keep up about 200 cars going on Saturday and Sunday. These cars were the objects of demonstrations, two of the vehicles having been dragged bodily from the lines, while the windows of many were smashed to atoms. Police on horse and on foot were on duty night and day, and on Monday evening the Argyll and Sutherland Highlanders, whose headquarters are at Glasgow, were summoned back from camp. For the three days ending Monday night the strikers were in almost continual conflict with the police, and over 100 arrests were made. On Monday afternoon the T.C. Committee met, but rejected a proposal to submit the points in dispute to B. of T. for arbitration, remitting the whole matter with full powers to Mr. Dalrymple, the general manager. In the meantime, many of the men had applied for reinstatement, and on Tuesday evening it was reported officially that the strike was at an end, over 80 per cent. of the men affected having been reinstated at the old terms, and the full service resumed. There is little likelihood of the men who took an aggressive part in the dispute being re-engaged. Fifty-five of them have handed in their uniforms and declined to return. Picketting is said to be again in progress as we go to press.

Ex-Bailie James McFarlane, a late convener of the T.C. Tramways Committee, has addressed a lengthy circular to his colleagues and the public generally, on the advisability of giving two of the present halfpenny car stages for a halfpenny. He quotes quite a plethora of statistics in favour of his arguments, and contends that the following safeguards and reservations must be made:—There must be paid to the common good a sum of at least £50,000; there must follow a readjustment of the average distance stages; a removal of unsuitable stations and overlaps; the penny fare will be restricted to a maximum of four stages; through minimum car fares, and no advance of wages to the employés.

Japan.—We learn by the latest Japanese mail that the amalgamation of the Yokohama Electric Co. and the Enoshima Electric Tramway Co. has been successfully carried through.

Liverpool.—At a meeting of the motor men and guards employed on the Liverpool and Crosby electrified section of the L. and Y. Rly. on the 10th inst., it was unanimously decided to do all in their power to assist their comrades, the goods workers on strike in Liverpool, by refusing to handle goods, and that, in the event of no immediate settlement being arrived at, they throw in their lot with those affected.

London. — L.C.C. — The tramway employés of the Council, after holding various meetings last week-end, have again asked the Council to receive a deputation in regard to a petition for various increases in pay, a more rapid rate of increase in pay to 6s. 6d. a day after 12 months: an 8-hour day spread over not more than 12 hours (*i.e.*, not more than four hours off between spells) and a pension fund. In commenting on this matter, the chairman of the Highways Committee pointed out that Conciliation Boards were formed in 1909 in conjunction with the men, who voted in favour of them. These boards have been called into action on three occasions since, the first decision resulting in an extra cost to the Council of £12,000 a year, and third in a further annual cost of £2,350. The fresh demands of the men would, he states, as regards the increased pay and 8-hour day above mentioned, amount to about £110,000 a year. The petition has already been considered by the Council, which was unable to grant the concessions asked for; it also decided against receiving a deputation, in view of the existence of the Conciliation Boards for settling such matters. At the present time the Highways Committee is on vacation, and notices were posted on Wednesday intimating that the members would not be recalled to consider the demands put forward.

A mass meeting of the men is to be held to-morrow, when a ballot will be taken to decide whether a strike shall be declared.

In connection with the above, it is stated that should a strike result, the Omnibus Companies' employés, together with those of many of the Tube and Underground Railways, will also leave work.

New Zealand.—The Christchurch Tramway Board is to borrow £35,000 for the purpose of doubling certain track and purchasing 18 cars.

Norton.—The R.D.C. has received a communication from the Dronfield U.D.C., stating that it had approached the Sheffield Corporation with a view to the running of railless cars to Dronfield. These, if provided, would run on the Sheffield and Chesterfield main road, and would serve Norton and Greenhill. The Corporation wished to know whether the Council approved the scheme, but before deciding it was resolved to obtain the views of the Norton Parish Council on the matter.

Oldham.—Much unrest prevails among the tramway employés, and the men have threatened to strike. The Tramways Committee has intimated that it will agree to the men's demand that in future no man shall be discharged for any offence without having full opportunity of giving an explanation. The Committee cannot agree to a suggestion to give a full day's pay to all regular men called out to work part time only, but every effort will be made to provide each man with a full week's work as far as possible. The last suggestion of the men, that they shall be compelled to join one of the unions after being employed one month, the Committee considered it could not accede to. A meeting of the men is to be held later in the week to consider the Committee's decisions.

Preston.—A strike has been threatened of drivers and conductors in the service of the Corporation Tramways. Alleging certain grievances last week, they tendered notices to the effect that, unless concessions were made, they would cease work on Saturday last. The decision was come to at a meeting of the men on August 10th, at which the grievances were fully discussed. Mr. J. F. Simpson, general manager of the tramways, is away from town at present, and on Friday a deputation representing the Tramway and Vehicle Workers' Union had an interview with Mr. Lafferty, the traffic superintendent. As a result of negotiations, certain modifications in regard to duty were arrived at, some of the men, who would probably have been called upon for extra duty, being granted release. Another dispute had reference to the rate of pay for overtime, and the men's representatives agreed that the point should stand over until the next meeting of the Tramways Committee.

Sheffield.—The Tramways Committee of the City Council has decided to double the single track on the Fulwood route near Riverdale Road, at a cost of £700.

Sunderland.—At a meeting of the T.C., on the 9th inst., it was decided that side lifeguards be fitted to the cars, at an estimated cost of £250.

Stalybridge.—Since the disastrous smash on the Stalybridge Joint Tramways at Ditchcroft Hill, Millbrook, on Whit Monday morning, the question of reconstructing the line has been under consideration, and it has now been decided to proceed with the work in order to render the line more safe. At the meeting of the T.C. on Monday the plans of the proposed reconstruction were approved.

Venezuela.—According to the British Consular report, there are openings at present for electric street railways in the town of Maracaibo. Sundry offers have been presented to the municipality of Maracaibo, but none has been approved so far.—*Board of Trade Journal.*

TELEGRAPH and TELEPHONE NOTES.

Anglo-Belgian Telephone Cable.—This loaded cable, 50 knots in length, manufactured by Messrs. Siemens, will be laid by the *Faraday* next Wednesday from St. Margaret's Bay to La Panne.

Brazilian Telegraphs.—The Ministry of Communications and Public Works is to spend about £36,000 for the construction of a building intended for the Postal Telegraph Office in Nitheroy, State of Rio de Janeiro.

London's Overhead Telephone Wires.—Last year, according to the City Engineer, seven miles 508 yards of derelict or disused wires were removed by the department. At the present time the National Telephone Co.'s spans crossing public thoroughfares total 735,136, as against 733,956 a year ago, and 260,000 in 1899.

Paris Telephones.—The *Journal Officiel* of August 1st publishes the text of a decree dated July 29th, authorising an expenditure of 11,667,700 francs (£466,708) for improving and extending the Paris telephone system.—*Board of Trade Journal.*

Rhodesia.—The *British and South African Export Gazette* states that purchases will shortly be made by the Administration of Southern Rhodesia of copper telegraph wire for installation along the railway from Salisbury to Bulawayo, and thence to the border of the Cape Province at Ramathlabama, the cost being estimated at £20,000. Considerable quantities of material will also be required for the installation of a double-wire telephone system at Bulawayo in place of the existing single lines, a scheme for which is under consideration.

The Telephone Transfer.—In the House of Commons on August 11th this Bill was further considered, and, after discussion and amendment, progress was reported. Early in the proceedings Mr. J. F. Hope moved to report progress, saying that there were important points still outstanding between the Department and the staff in regard to Clause 5 (provision as to superannuation of transferred officers), and urging that these points be held over until the autumn, in the hope that in the meantime agreement might be arrived at. Mr. Joynson-Hicks and Mr. Brady also supported the claims of the telephone staff. It was stated that there were about 400 men whose demands had not been conceded. The P.M.G. said that these men were doing work which was done by Post Office servants who were not on the establishment. The Post Office servants had been in the service many years, and they could hardly be expected to work side by side with men who were put in a better position (made pensionable) purely because they were taken over. The matter affected not only those 400, but 5,000 men now in the Post Office service, and to put all of these on a pension basis was a very large financial question. The matter was under the consideration of the Treasury. Ultimately Mr. Samuel said that he perceived that there was a general desire that a further attempt should be made to arrive at a settlement of the outstanding point, and he agreed that the postponed clause should come up for consideration one day this week, and if no settlement had then been reached, the Bill would go over to the autumn session. The motion to report progress was then withdrawn, and several amendments in Clause 6, which contains a number of temporary provisions for the transfer, were made.

Wire Stealing in Manchuria.—The cutting and stealing of the telegraph wires seems to be an everyday occurrence in Manchuria, the South Manchuria Railway Co. having experienced no fewer than 88 cases of the kind during the last three months.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—September 5th. (*a*) 10,000 protectors and (*b*) sundries, for the P.M.G.'s Department. See "Official Notices" July 28th.

South Australia.—August 23rd. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" July 14th.

New South Wales.—Telephone, telegraph and electric light material for a year, and a dessiccating plant for the P.M.G.'s Department. See "Official Notices" July 28th.

Queensland.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

Melbourne.—October 3rd.—42 miles of paper-insulated, lead-covered telephone cable, for the P.M.G. See "Official Notices" to-day.

September 26th.—30 miles of paper-insulated telephone cable, also supply of various telephone material. Local representation. Deposit, with tender, 5 per cent. up to £1,000 and 2½ per cent. above. Specification, &c., may be seen at Office of High Commissioner, in London, 72, Victoria Street, S.W.

Bathgate.—Bathgate District Committee of Linlithgow County Council invite tenders for the supply and erection of one suction gas producer plant of 120 B.H.P. capacity and a 120-B.H.P. gas engine, vertical type, erected at Broxburn electric station, Broxburn. Mr. Wm. Sanderson, resident engineer, Electric Station, Broxburn.

Belgium.—September 13th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the overhead electrical equipment of the extension of the Charleroi-Jumet (Heigne) light electric railway to Lodelinsart (Saint Antoine).

Bolton.—August 24th. 25,000 tons of bituminous engine slack, for a year, for the Corporation electricity works. A. A. Day, Borough Electrical Engineer, Spa Road.

Cleethorpes-with-Thurnscoe.—September 2nd. Vulcanised bitumen distribution and feeder cables, for the U.D.C. See "Official Notices" August 11th.

Hungary.—September 30th. The municipal authorities of Beszterce are inviting tenders for the establishment of a central electric lighting station in the town.

Ipswich.—August 24th. Paper-insulated cables for a year for the Corporation. See "Official Notices" August 11th.

London.—G.P.O.—September 18th. Creosoting, &c., telegraph poles for the G.P.O. G. Morgan, Controller of Stores, G.P.O., 17-19, Bedford Street, W.C.

September 2nd. Battery boosters and switchboards for the Westminster Electricity Supply Corporation, Ltd. See "Official Notices" to-day.

Penang.—September 5th. One 500-KW. steam dynamo (engine or turbine), with ejector condensing plant and switchgear, for the Municipality of George Town, Penang. See "Official Notices" August 11th.

Roumania.—August 23rd. The municipal authorities of Calarashi are again inviting tenders for the concession for the electric lighting of the town.

Russia.—The municipal authorities of Omsk are about to invite tenders for the concession for the establishment and operation of a central electricity generating station for lighting and power purposes and also for the construction and working of an electric tramway in the town.

Salisbury.—Electric lighting of the Salisbury and District Joint Isolation Hospital. See "Official Notices" July 28th.

Servia.—September 4th. The Servian State Railway Authorities in Belgrade are inviting tenders for an installation of electric lighting at the railway station at Nisch.

Spain.—The municipal authorities of Chilches (province of Castellon) have just invited tenders for the concession for the electric lighting of the town during a period of 25 years.

Stoke-on-Trent.—Coal and slack, for a year, for the four electricity works of the T.C. Electrical Engineer, Hanley.

Swinton and Pendlebury (near Manchester).—August 22nd. Electric lighting of new Cromwell Road School, Pendlebury. Particulars from J. T. Bushell, John Dalton Street, Manchester.

Syria.—September 15th. The Turkish Ministry of Public Works in Constantinople is inviting tenders for the concession for the construction and working of a system of electric tramways, and for the supply of electrical energy for lighting and power purposes in the town of Aleppo, Syria.

West Ham.—August 31st. Water-tube boilers, coal-handling and discharging plant, 5,000-KW. turbo-alternator, with condensing plant, river service pipework, centrifugal pumps, and one 750-KW. converter, for the Corporation. See "Official Notices" August 4th.

Wolverhampton.—Buildings and plant for a 1,000-KW., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" July 14th.

CLOSED.

Ashton-under-Lyne.—The Electricity Committee has accepted the tender of Mr. John Robinson for No. 2 cooling tower foundation.

Australia.—Balmain.—The Balmain Electric Light and Power Supply Co., Ltd., have placed an order with Messrs. Willans & Robinson, Ltd., for a 500-kw. Willans impulse disk and drum mixed-pressure steam turbine coupled to a General Electric alternator and exciter. The turbine will exhaust into a vacuum augmentor surface condensing plant which Messrs. Willans and Robinson will also supply.

According to the *Australian Mining Standard* the Prahran and Malvern Tramways Trust has accepted the tender of Younger and Howitt, being the lowest tender, for construction of permanent way for the Dandenong Road line, at schedule rates.

South Australia.—P.M.G.'s Department. The same exchange also reports the following p aced contracts:—

3,000 zincs for primary batteries.—India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., 8¼d. each.

Western Australia.—Railway Department:—

5,000 Cordeaux insulators.—Doulton & Co., Ltd., £171.

Barnstaple.—The T.C. has sealed an agreement with the D.P. Battery Co. for the supply and maintenance of a new battery of accumulators at the electric light works.

Bordon Camp Electricity Supply.—Messrs. Willans and Robinson, Ltd., have received an order from the War Office for three Willans-Diesel direct-current generating sets to the specification of Messrs. Kennedy & Jenkin.

Dundalk.—With reference to our note under this heading last week, we are informed by the Sandycroft Foundry Co., that the complete battery for which they have received the contract, will be manufactured in their own new accumulator factory at Sandycroft, the company having taken over the business of W. O. Rooper & Co., and the Epstein Accumulator Co.. some months ago.

France.—The French Post and Telegraph Authorities have just equally divided an order for 20,000 metres of steel tubes, for use in connection with pneumatic dispatch lines, between the Société Française pour la Fabrication des Tubes, of Louvroil (Nord), and the Société d'Exaut et Meuse, of Liége.

Gravesend.—The Electrical Committee has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for the supply of Lambton rough coal.

Middlesbrough.—Messrs. Fraser & Chalmers, Ltd., have just booked an important order for two of their Rateau turbines of the mixed pressure type for direct coupling to turbo blowers for Messrs. Bolckow, Vaughan, Middlesbrough, in connection with their extensive blast furnace works, making in all 12 turbines supplied to this company.

Plymouth.—The tender of Messrs. J. Baker & Sons, Ltd., has been accepted by the T.C., at £101, for suppying and fixing an electrically driven Hodgkinson dough-mixing machine.

Salford.—The Electricity Committee has accepted the following tenders for coal for the ensuing 12 months:—

Clifton & Kersley Coal Co., Ltd.—20,000 tons.
Andrew Knowles & Sons, Ltd.—10,500 tons.
The Earl of Ellesmere.—7,500 tons.

Sunderland. — The T.C. has accepted the following tenders:—Henley's Tel. Works Co., 440 yds. 19/20 cable, 220 yds. 19/16 cable; British Insulated and Helsby Cables, 220 yds. 19/18 cable; J. and R. Ritchie, Middlesbrough, and W. G. Farrow, Newcastle-on-Tyne, cast and wrought-iron pipe-work; Gwynnes, Ltd., London, one low-lift pump.

Wallsall.—The T.C. has accepted the tender of Messrs. Isaac Storey & Sons, Ltd., for supplying and erecting two sets of jet condensing plant of the low level counter current type, at £1,163.

NOTES.

Australian Lamp Contract.—We read in the *Australian Mining Standard* that the Footscray (V.) City Council recently received a letter from Mr. W. C. Rowe with respect to the tendering for metal-filament lamps. The writer said he understood that his tender was the lowest, but was not accepted, because his principals, the Pope Electric Lamp Co., did not comply with the 1·1 watts per candle-power. He asked, that in fairness to himself and other tenderers, the spirit of the specifications be faithfully carried out, and the lamps tested by a competent and disinterested party. He tendered on the assurance that by candle-power the Council intended British candle-power. They had accepted German candle-power, which was only 89 per cent. of the British. One Councillor thought that some attention should be paid to the point raised; another thought that the Council's electrical engineer should be relied upon; the Mayor was of opinion that it would have been better if the letter had not been written. The letter was formally "received."

The House I Built.

Dedicated to the Top Dog.

My Training:

E'en while I tended the solder pot
I thought 'lectricity rather rot,
And finding I couldn't make wiring pay—
I started on the "Consultant" lay.

My Apotheosis:

I bought a hat with a glossy sheen,
I cultivated a stately mien:
I asked the Council and Mayor to sup
And, as expected, they snapp'd me up.

My Debut:

I got the job to prepare the plans
(I managed to crib another man's)
And specifications by the ream
For the Council's pet electric scheme.

My Specification:

As I haven't an Arbitration Clause,
My acts are above my Country's Laws;
And my specifications all embrace
Suitable clauses to save my face.

My Site:

This is my site, and the Building stout
(As the roof went on the walls bulg'd out)
In case of collapse the Builder pays,
But if it endures—then mine the praise

My Boilers:

These are the boilers that burn my coals—
(I specified rivets in all the holes)
I am going to paint them duck egg blue
With a deep gold line around the flue.

My Conveyor:

This is my fuel conveyor set
'Twas built and designed in Scotland, yet
The Mayor and Council and I agree
That all the credit belongs to ME.

My Steam Pipes:

My steam pipes are steel and nearly round,
I specified this because I found
That pipes of tin with a soldered seam
Were not a success with high press. steam.

My Turbines:

Now we arrive at my Turbine sets—
It hurts me to think that Parsons gets
Some of the credit for their design
When the gold lined paint is wholly mine.

My Condensers:

My condensing plant is down below
With Edwards' pumps and turbulent flow;
And other improvements in design
I don't understand, but claim as mine.

My Cables:

My cables are straight and dead in line
I never allow a bend in mine—
It throws the rotaries out of phase
When volts are trav'ling different ways.

My Switchboard:

My bosom the switchboard swells with pride,
As I couldn't design it though I tried
I left the makers to bear the brunt,
But I specified my name in front.

My Notices:

And every Saturday, more or less,
I get my puff in the local Press;
(I've the reporters "under the quilt")
A wonderful house, the House I built.

Australian.

Working of Coal-Cutting Machines.—Before Hon. Sheriff-Substitute Watson, in Falkirk Sheriff Court last week, a case of great interest to those employed in mines where electricity is used, was heard. We referred to the matter briefly in our last issue.—George Ferguson, machine man, Carron View Terrace, Polmont Station, was charged with a contravention of the Coal Mines Regulation Act, 1887, and the special rule in force in No. 1 pit, Craigend Colliery, Polmont, in respect that, being the person in charge of the coal-cutting machine, he failed to observe the directions given him in printed form to the effect that before starting the machine he should have seen that the earth wires were properly fixed both to the machine and the gate-end box.—Accused admitted that he had not made the connection properly.—The prosecutor explained that the earth wires carry away the electricity. When not properly connected any person touching the machine was liable to a very serious accident, and deaths had been caused in such a way. In the rules it was laid down that the operator must see that the connection was properly made before starting the machine. The accused himself, the Fiscal stated, was a victim of his own negligence, and as a result of the shock received, he was off work for three weeks. Looking to the fact that accused had suffered, the Sheriff modified the penalty to one of 5s. He expressed the hope that the case would be a warning to others.

Carmarthen Electric Supply.—With reference to our description of the above undertaking in the Electrical Review of August 4th last, we may mention that the whole of the mains and street lighting work was carried out by Messrs. J. B. Saunders and Co., of York Street, S.W.

Institution and Lecture Notes.—City and Guilds (Engineering) College, Exhibition Road, S.W.—We have received from Prof. T. Mather a short syllabus of an advanced course of instruction on "The Systematic Design and Manufacture of Dynamo-Electric Machinery," to be given under his general supervision in the above college during the forthcoming session. The lecturer will be Mr. W. E. Robson, M.I.E.E., and the fee for the course is £22. We understand that the course will be unique, and it is intended to prepare men to take up positions as designers in electrical works. It will deal with the present-day problems in design, construction and testing in a thoroughly practical manner. An experienced designer and draughtsman, specially engaged for the purpose, will devote his whole time to the drawing office work in connection with the course. Communications should be addressed to the Dean, at the College.

Institution of Civil Engineers.—The Council have made the following awards in respect of students' papers read during the session 1910-11:—The "James Forrest" medal and a Miller prize to Mr. D. Hay, B.Sc., Birmingham; and Miller prizes to Messrs. D. A. Howell, Bristol; R. Bonner, Bristol; G. F. Walton, London; R. G. Parrott, Manchester; E. E. Farrant, London; A. C. Dean, B.Sc., Manchester; H. W. Coales, Birmingham; A. H. Meade, London; A. C. Swales, Leeds; and H. J. F. Gourley, B.Eng., Manchester.

Electrical Association of N.S.W.—At a June meeting of this Association, a paper read by Mr. T. P. Strickland at the last meeting of the Association, entitled "Notes on the Earthing of the Neutral on Three-phase High-tension Systems," was discussed. Mr. R. D. Dixon read a paper on "Notes on Some Practical and Theoretical Considerations in Determining the Correct Position of Trolley Wires and Fittings."

Victorian Institute of Electrical Engineers.—According to the *Mining and Engineering Review*, a special meeting was held on June 29th, at which it was decided, "That it shall be a condition of election to the Council that the members named shall have had a contribution accepted by the Institute." At a subsequent ordinary meeting two notices of motion by Mr. Clement Newton were submitted, as follows:—(1) "That this meeting requests the Council to consider the practicability of bringing pressure to bear upon Government departments, corporate bodies, and others, to insert proper and fair arbitration clauses in specifications issued by them; and to communicate with other similar institutions, with a view to their assisting to bring about the desired result." (2) "That this meeting is of opinion that it is advisable to formulate a code of ethics for its members on the lines of that issued by the Institute of Civil Engineers, London, and requests the Council to take steps to this end." It was decided, after some discussion, to try and induce other similar bodies to join in an effort to give effect to the first motion. The second motion was defeated, the feeling being that, as the Institute is not composed solely of consulting engineers, and as it is not a chartered body, it would be impossible to give effect to such proposals.

Electrical and Other Fatalities.—At an inquest at Cheltenham on the body of a workman who was crushed to death beneath an electric cable drum, which he was assisting to unload from a lorry, the jury found that no blame was attachable to any individual, but that, in their opinion, the electricity department did not provide sufficient staff or control for the weight the men in their employ were handling at the time of the occurrence.

The *Sunderland Echo* states that Frank Best, of Middlesbrough, was, on the 11th inst., killed at Smith's Dock, Southbank, while engaged in finishing a ship. An inquest was held at Middlesbrough on Tuesday on the body of Best, who was a caulker at Smith's Dry Dock. Along a jetty at the dock an electric crane runs, which gathers its power from three live wires with a pressure of 440 volts. These wires are in a conduit. Best, while walking along the jetty, dropped a packet of white lead, which fell into the conduit, and, in trying to recover it, he touched the live wires and was instantaneously killed. He was found lying across the crane rails, with his left arm through the conduit, and his hand grasping the live wires. A verdict of "Accidental death" was returned.

The tragic death of a Burslem boy, through a piece of wire he was carrying acting as a lightning conductor, was described on Monday to the North Staffs. Coroner at an inquest. Samuel Gater, a potters' placer, said that on Friday night he saw the deceased, Reginald Wright, aged 10 years, on a piece of waste land dragging a tin box by a piece of wire. He saw a flash of lightning apparently strike the box, and the boy fall to the ground. He ran to him and found him dead. Dr. W. T. Shields said that on the boy's right side there were two distinct lines, back and front, as though drawn by a pencil. The boy evidently had the wire over his shoulder. A verdict was returned in accordance with the medical evidence.

Electrical Workers' Agitation in Germany.—According to Reuter's agent in Berlin, 3,000 electrical engine fitters and assistant electrical engine fitters of Greater Berlin, forming the German Metal Workers' Union, decided last week to agitate for higher wages.

Lap and Wave Windings for D.C. Armatures.—In connection with the article on the above on page 213 of our last issue, the author points out that the formulæ in the 14th and 16th lines from foot of right-hand column, page 214, should read, $Y = \frac{Z \pm 2}{p}$ and $p \times Y = Z \pm 2$ respectively; also the word "armatures" should read *armature*.

An Australian Conference.—According to the *Sydney Morning Herald*, a 10 days' Conference was opened there on July 13th of the electrical engineers for the several States. They were to discuss a wide range of subjects relating to the electrical services of the Post Office with a view of effecting improvements, as the result of mutual suggestions, and of bringing the methods of all the States into uniformity.

Appointments Vacant.—Shift engineer for Leigh Electricity Works (32s. 6d.); junior shift engineer for Lancashire Electric Power Co. at Radcliffe (£9 per month). Lecturer and instructor in telephony for Wimbledon Technical Institute. See our advertisement pages to-day,

Parliamentary.—In the House of Commons on August 9th, the East Kent Electric Power Bill was read a third time.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At the Grand Hotel, Middlesbrough, on Friday night last, a dinner and smoking concert was held in honour of Mr. C. H. Lydall, of the staff of the Cleveland and Durham Electric Power, Ltd., who is leaving England to take up an important position on the staff of Messrs. Merz & McLellan, as their representative in the Argentine. Mr. A. B. Gridley, manager of the Power Co., presided at the dinner, and in presenting Mr. Lydall, on behalf of the staff, with a fitted suit case and pipes, referred to the exceptionally good work he had done in the company's Bishop Auckland area, and wished him every success in his new appointment. Mr. Lydall suitably responded. A most enjoyable evening was spent in harmony and song.

On August 9th, the staff of the St. Pancras Borough Council Electricity Department presented Mr. J. H. Bryan with a handsome marble timepiece to celebrate the occasion of his marriage. The presentation was made by Mr. A. E. Pycraft, supported by other members of the staff.

The *Australian Mining Standard* states that the Newcastle (N.S.W.) Council has appointed Mr. Guy Allbut, who has filled the position of electrical engineer to the Tamworth Municipality for the past two years, as its electrical engineer at a salary of £350 per annum.

General.—The following changes in Post Office appointments are announced:—Mr. Edward Crabb, C.B., has been appointed second secretary in succession to Sir A. F. King, K.C.B., promoted to be secretary. In view of the approaching transfer of the National Telephone Co.'s business to the Post Office, and in order to secure a proper co-ordination of the work of the telegraph and telephone departments, the Postmaster-General has established a post of third secretary with supervision over those departments. Mr. A. M. Ogilvie, hitherto assistant secretary in charge of the telephone department, has been appointed third secretary. Mr. A. B. Walkley and Mr. L. T. Horne have been promoted from principal clerks to be assistant secretaries to the Post Office.

The *Times* for August 15th contains under "Marriages" the following announcement:—"Parshall: Johnson.—On August 5th, at Folkestone, Horace Field Parshall, D.Sc., M.Inst.C.E., of 59, Netherhall Gardens, N.W., to Bertha Johnson, of Scruton, Yorkshire." Congratulations.

Indian Engineering states that Mr. A. Leslie, deputy superintendent of telegraphs, has been deputed by the Government telegraph department for special duty at Calcutta for one year in connection with the Eastern Bengal and Oudh and Rohilkhand State Railway.

Mr. E. M. Herr was on August 1st elected president of the Westinghouse Electric and Manufacturing Co., of U.S.A. He had been first vice-president since 1905. Mr. Herr succeeds Mr. E. F. Atkins, who was elected in June, 1910, but this year declined re-election.

Mr. Philipp Laubach has resigned his position as manager to Messrs. Frampton & Paine, of Westminster, in order to take up the position of manager of the switchgear department of the Electrical Engineering and Agencies Co., Ltd., of New Oxford Street, W.C.

Mr. W. H. Hobbs, clerk at the Taunton Electricity Supply Works, recently resigned his post in order to take up a position with the British Thomson-Houston Co., Ltd.

NEW COMPANIES REGISTERED.

Flynn Manufacturing Co., Ltd. (117,137).—This company was registered on August 4th, with a capital of £1,000 in £1 shares, to carry on the business of machinery and plant manufacturers, insulators of wire, wire coil and other metals, &c. The subscribers (with one share each) are:—C. Terry, Southcrest, Redditch, spring manufacturer; A. E. Terry, Brambles, Redditch, spring manufacturer; A. V. Terry, Oakenshaw, Redditch, spring manufacturer; T. J. Flynn, 10 and 11, Billiter Square Buildings, E.C., merchant; H. Minns, 25, Abbots Road, King's Heath, manager; E. Clarke, Easemore Road, Redditch, clerk; A. E. Wheeler, William Street, Redditch, clerk. Private company. The number of directors is not to be less than three or more than seven; the first are C. Terry, A. E. Brambles, A. V. Terry and T. J. Flynn; qualification, 100 shares. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Braunton Electric Light and Power Co., Ltd. (117,202).—This company was registered on August 10th, with a capital of £5,000 in £1 shares (1,000 5 per cent. cumulative preference), to carry on the business indicated by the title, and to adopt agreements (1) between S. I. Knill and the Parish Council of Braunton; and (2) between the said S. I. Knill and Crompton and Co., Ltd. The subscribers are:—T. Yeo, Southlea, Braunton, Devon, land valuer, 50 shares; H. S. G. Clarke, East Hill, Braunton, Devon, master mariner (retired), 50 shares; J. K. Symonds, 1, The Terrace, Braunton, Devon, retired tea planter, 50 shares; F. W. Moon, West Cross, Braunton, Devon, baker, &c., 1 share; W. Manaton, Hillside, Braunton, Devon, tailor and outfitter, 1 share; T. Slee, Springfield, Braunton, Devon, retired grocer, 1 share; S. I. Knill, 71, Southport Street, Barnstaple, Devon, engineer, 1 share. Minimum cash subscription, £2,000. The number of directors is not to be less than three or more than five; the first are T. Yeo, H. S. G. Clarke and J. K. Symonds; qualification, £50. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Venner Time Switches, Ltd.—Particulars of £5,000 debentures, created July 4th, and secured by trust deed dated July 10th, 1911, filed pursuant to Sec. 90 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustee: R. B. Young, 18, The Chase, Clapham Common, S.W.

Cutting Bros., Ltd.—Particulars of £4,000 debentures, created July 12th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Corona Lamp Works, Ltd.—Particulars of £2,000 debentures, created July 10th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Melbourne Electric Supply Co., Ltd. (63,334).—Trust deed dated August 3rd, 1911, to secure not more than £250,000 second debenture stock, charged on the company's assets, present and future, subject to first mortgage debenture stock. Trustees: Electric and General Investment Co., Ltd., 1-2, Great Winchester Street, E.C.

CITY NOTES.

Metropolitan District Railway Co.

THE ninety-fourth half-yearly ordinary meeting of the shareholders of the above company was held on Thursday, last week, at the Westminster Palace Hotel, Lord George Hamilton presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 226), said that, dealing first with the capital account, the expenditure for the half-year amounted to £88,668, of which £10,686 was part payment of arrears of dividend on guaranteed stock. They had spent £12,100 on the development of surplus land, £9,085 on new works and additions, £12,472 upon reconstruction and improvement of stations, and £39,517 had been spent on the construction of new cars. For the forthcoming half year they estimated they would spend £90,000 on capital account, including £51,000 for new rolling stock, leaving a balance of £78,000 to be incurred in subsequent years. Shortly after the prior lien stock was created, they had an offer from the Tilbury Co. to purchase certain of their rolling stock for the sum of £130,000. They, therefore, undertook for the time being to reduce the further issue of the prior lien stock by this amount, reserving to themselves the right subsequently to issue the amount thus postponed after consultation with the debenture-holders. The holders of debenture stock now occupied a very much stronger position than they did at the time that understanding was arrived at, and as they would soon require additions to their rolling stock to enable them to handle their growing traffic, they proposed to acquaint the debenture-holders shortly with their intention to issue £130,000 prior lien stock thus reserved for the purchase of additional rolling stock to replace that sold to the Tilbury Co. Last year an order was placed for 51 additional carriages, but with the rapid growth in traffic this increase would not be sufficient for next winter's service, and a further order had been placed for 14 carriages. The half-year's working showed an increase of £27,124 in gross receipts, and an increase in passengers of 4,359,000 over the number carried in the corresponding period of the last half-year. The Coronation and its festivities contributed to this increase, also the opening of the Earl's Court Exhibition grounds. But quite independently of the Coronation and the crowds it brought to London, the traffic showed a general and satisfactory increase. The working expenses showed an increase of £9,410; this was due to improved and increased train service, extensions, improvements in the rolling stock, and to the exceptional outlay due to the Coronation period, including an extra day's pay to nearly the whole of the staff. Eliminating this exceptional expenditure, and taking a comparison between this half-year and the half-year ending June 30th, 1910, they found that the operating expenses per car-mile in pence showed a reduction of ·006, and per car-hour of ·259. The percentage of operating expenses to their gross receipts stood for the half-year at the ratio of 46·69. Analysing the increase in the passenger traffic over the corresponding period by class and tickets, they found the following:—First class, increase 5·96 per cent.; third class, increase 12·25 per cent.; workmen's tickets, increase 6·08 per cent.: season tickets, increase 21·04 per cent.; total increase, 12·05 per cent. The result of the half-year's working was that they had a balance available for dividends of £82,991. This balance showed an increase over the balance in the same period last year of £20,715, but that increase included the balance carried forward from last half-year of £2,020. This balance it was proposed to distribute as follows:—£28,714 18s. 10d. to the 4 per cent. guaranteed stock, which was at the full rate of 4 per cent. per annum; £6,250 in paying the third warrant for 10s. per cent. in respect of the arrears on guaranteed stock, and £33,750 in the payment of a dividend on the first preference stock at the full rate of £4 10s. per cent. per annum. This left a carry forward of £14,277, as against the balance of £8,528 for the corresponding period of last year—an increase of £5,749. Rapid progress continued to be made with the widening of the railway between Ravenscourt Park and Acton Lane Junction. They expected to work over the new lines no later than November of this year. This would afford the company an opportunity of working a closer and more regular service of trains to Ealing and other points on the western lines. It was also proposed to increase the number of non-stop trains during the "rush" hours in the morning and evening. Another improvement which would benefit the company was the extension of the London electric railway from Charing Cross to the Embankment Station, powers for which were obtained by that company this year. The extension would provide suitable interchange facilities between the District, Hampstead and Highgate, and Bakerloo Railways, and would result in increased traffic to this railway. At the last half-yearly meeting a question was put to him by a shareholder as to whether they were likely to embark in any heavy expenditure for the electrification of the East London Railway. The lessee companies had agreed upon a scheme for electrifying the East London Railway. Negotiations were now in progress with the East London Co., and it was hoped that matters would be finally adjusted so that the work could be put in hand at a very early date. The proposal was that the Metropolitan Co. were to work a through service of trains (four per hour), and a close service of local trains to work between Shoreditch, Whitechapel and New Cross, with convenient interchange arrangements provided at Whitechapel, so that passengers could conveniently change from District trains to East London trains. One of the lessee companies was to provide the necessary capital required for the electrification of the line. The East London Railway Co. were to enter into an agreement to apply their proportion of the receipts, when exceeding the minimum of £30,000 per annum, to the payment of interest at 4 per cent. per annum on the outlay so far as the receipts might be sufficient for the purpose, any balance remaining unpaid at any half-year, to accumulate at 4 per cent., and to be payable out of any future receipts above the minimum. Terms for the supply of electrical energy had been agreed to by the District Co. The Metropolitan District Railway Act, of 1911, the Bill for which had their approval on February 9th last, received the Royal assent on June 2nd. The negotiations with the Underground Electric Railways Co. of London, Ltd., for the sale of the power house to the Joint Committee of London Electric Railway and the District Railway Companies had been successfully concluded, and he could safely say that the bargain was a fair one for all parties concerned. It was proposed that the Lot's Road power house undertaking be transferred to the Joint Committee, which consisted of three members of the board of this company and three members of the board of the London Electric Railway Co. and leased by the Joint Committee to the two companies as from January 1st, 1912. The future outlook for the railway was bright. With the growth of their traffic they ought gradually to bring to more and more of their shareholders the benefit of a dividend. On the other hand, the location and environment of their enterprise were such that they would always be subject to keen and possibly to new forms of competition. Relations with their competitors and other underground railways continued to be friendly. They recognised that, through co-operation, and by each company giving the best possible service, they would bring the best results to the respective undertakings. They could not, therefore, afford to make a mistake. Caution must be combined with future developments, and under this associated impulse, their expansion—even if it were slower than was agreeable to all the shareholders—should be continuous and unbroken.

MR. W. H. BROWN seconded the motion, and the report was adopted.

"Harper" Electric Piano (1910), Ltd.—The directors have declared a dividend for the half-year ended June 1st, 1911, at the rate of 5 per cent. per annum on the participating ordinary shares, making, with the interim dividend already paid, 5½ per cent. for the year.

Tyneside Tramways and Tramroads Co.—The directors have declared a dividend of 1½ per cent. per annum (1s. 6d. per share), less income-tax, on the ordinary shares, for the half-year, placing £1,000 to reserve for renewals, depreciation, &c., making £10,100, writing £530 off preliminary expenses account, and carrying £620 forward.

London Electric Railway Co.

The half-yearly ordinary general meeting of the shareholders of the above company was held on Thursday last week, at the Westminster Palace Hotel, Lord George Hamilton presiding.

In moving the adoption of the report, the Chairman said that the capital expenditure during the half-year had amounted to £47,222, the most important item being the cost of the escalator at Earl's Court, which work they hoped would be completed very shortly. Their Bill for extensions at Charing Cross and Paddington had received the Royal assent, and it was anticipated that the extensions would be a great convenience to the travelling public. Tenders for the work had been received, and it was hoped that a contract would be entered into within the next few days, the intention being to proceed with the extensions as rapidly as possible. During the year they had sold £150,000 of debenture stock, the proceeds of which would be used towards paying the cost of this work. Turning to the revenue, the gross receipts for the half-year had amounted to £392,817, being an increase of £27,193 over the corresponding period. The exceptional traffic associated with the Coronation festivities accounted for a certain proportion of that increase, but quite independently of such abnormal expansion the weekly traffic receipts for periods unconnected with the Coronation contrasted very favourably with similar weeks during the corresponding period. The working expenses had amounted to £174,919, being an increase of £7,699. As a result of recent assessments they had had to pay £2,900 more in local rates during the half-year, and increased and improved train services accounted for the rest of the additional expenditure. It was satisfactory to note that the ratio of working expenses to gross revenue had diminished and now stood at the low figure of 44·53. Including the balance brought forward, they had £124,156 available for dividend, against £105,000 for the same period last year. They proposed to pay the full dividend of 4 per cent. on the preferred stock, which would require £63,000 and 1 per cent. on the ordinary stock, which would require £46,639, leaving a balance of £14,516 to be carried forward, against £12,400 in the corresponding half-year. The ordinary stock outstanding amounted to £9,327,000, therefore 1 per cent. upon that stock represented £93,000 a year. To those who had invested in the preferred stock, it must be most satisfactory to note that in so short a period since its creation they were enabled to put £93,000 behind that stock as the dividend on the ordinary shares. Having referred to the arrangement by which the Lot's Road power house undertaking was to be purchased and worked by a joint committee, the chairman said that the figures he had given them demonstrated the growing financial strength of the enterprise, and if care were exercised in the planning, supervision and construction of further developments year by year, the company would become stronger and more remunerative.

Sir Algernon West seconded the motion, and the report was adopted.

Mexican Light and Power Co., Ltd.

The report for 1910, which was submitted to the meeting at Toronto on 11th inst., is quoted in the *Financial Times* as follows :—The business has shown constant and satisfactory increases, well warranting the extension of the work, which was authorised and commenced in 1909. Most of this work has already been completed, and the remainder—namely, the construction of the Tenango and the Nexapa reservoirs—is well advanced. The net revenue in gold for the year, after paying all expenses and fixed charges, amounts to $1,456,612, which, together with $149,385 brought forward from 1909 and $163,004 set aside from the profits of 1909 to provide for the accrued portion of the quarterly dividend on the ordinary shares paid January 15th, 1910, and the accrued portion of the half-yearly dividend on the preferred shares paid May 1st, 1910, makes a total credit balance of $1,769,002. Out of this sum the directors have paid during the year to the shareholders $860,150, being 7 per cent. on the preferred shares, and 4 per cent. on the ordinary shares. The balance carried forward to profit and loss account is $745,848, and the reserve account remains at $377,883. In view of the constant increase in the demand for electric power and other additional business which will be available for the company in the near future, it has been decided to further extend the system of canals and tunnels, so as to divert some of the other rivers included in the company's concessions, into the Necaxa water shed. Contracts have already been let for the construction of this work, which should be completed towards the end of the year 1912, and in time to meet the demand for power, which it is anticipated the company will be called upon to supply at that date. The purchase of the business and undertaking of the Compania Electrica e Irrigadora en el Estado de Hidalgo,S.A., was completed during the year 1910, and the results justify the action of the board in acquiring it. For the convenience of working, the business and the undertaking were vested in the Pachuca Light and Power Co. (Compania de Luz y Fuerza de Pachuca, S.A.), all the capital stock of which is owned by the Mexican Light and Power Co., Ltd. The Pachuca Light and Power Co. is now supplying light and power to all the customers of the old Irrigadora Co., and the earnings from the business are much larger than were estimated in last year's report. A transmission line has been constructed from the line of the Mexican Light and Power Co., Ltd., to the lines of the Pachuca Light and Power Co. at Pachuca. At the present time the Pachuca Co. is taking 9,500 H.P., which it is selling in addition to the regular output from its own plants.

Mexico Tramways Co.

The directors' report for 1910, which was submitted to the meeting at Toronto on 11th inst., as abstracted in the *Financial Times*, states that the net revenue in gold for 1910, after paying all expenses and fixed charges, amounted to $1,417,303, which, added to $416,344, the balance brought forward from 1909, makes a total credit balance of $1,833,647. During the year two quarterly dividends of 6 per cent. per annum, and two quarterly dividends at the rate of 7 per cent. per annum, were paid to the shareholders, absorbing $939,581, thereby leaving a balance of $894,066, out of which $250,000 has been added to the reserve account, which now amounts to $2,513,087, and $644,066 has been carried forward. The ratio of operating expenses to gross income was 49·06 per cent., as compared with 50·02 for 1909. For the purpose of providing funds for the general purposes of the company, including carrying out extensions and making advances to the Mexican Light and Power Co., Ltd., in connection with the construction of its additional hydro-electric installations, the company during the year issued and sold a further 50,000 shares of its capital stock. The physical condition of the property, rolling stock and plant has throughout the year not only been well maintained, but in many respects the standard of its efficiency has been improved, nearly $700,000 having been expended during the year on maintenance. On December 31st, 1910, the system consisted of 179 miles of single track, of which 158 miles were operated by electricity, and 21 miles by mules, the electric track mileage having been increased by 13 miles, and the mule track having been reduced by five miles. Besides increasing the track mileage, as above stated, the company during the year built additional cars and finished the construction of car barns, substations and shops, erected additional store-houses and passenger stations, and also completed the installation of fire protection appliances throughout the buildings. The operation of the new suburban line to Lake Xochomiloo and of the new city lines and extensions put in operation during the year has given very satisfactory results. The company proposes in the new future to extend its lines in various outlying districts.

Prospectus.—*Braunton Electric Light and Power Co., Ltd.*—The subscription list opened on Tuesday, and will close by August 31st, in an issue of 2,750 ordinary shares of £1 each and 500 preference shares of £1 each. Braunton (Devon) is rapidly becoming a popular residential resort, many new premises have been erected, and the demand for building land is good. Messrs. Crompton & Co., Ltd., the contractors, estimate the cost of the necessary works at £2,950, and £300 is required for preliminary expenses, working capital, &c. Consumers are to be charged 2s. per quarter for each approved 32-c.p. metallic-filament lamp or 8-c.p. carbon lamp in living rooms and shops, with a reduced rate for bedrooms and other "occasional" situations. Messrs. Crompton estimate the income at £419 per annum, and the expenses, including depreciation at £217, leaving £202 for dividends, directors' fees and office expenses, but increased profits are expected as the undertaking develops. A 5 per cent. dividend would require £162 10s.

Gandy Belt Manufacturing Co., Ltd.—The directors are paying an interim dividend of 4 per cent., against 3 per cent. a year ago.

Continental.—Belgium.—La Société des Centrales Eléctriques des Flandres is the name of a new company which has just been formed in Brussels with a capital of £4,000.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List :—

Melbourne Electric Supply Co., Ltd.—20,000 7 per cent. first cumulative preference shares of £5 each, fully paid.

Notting Hill Electric Lighting Co., Ltd.—2,998 6 per cent. cumulative preference shares of £10 each, fully paid (Nos. 1 to 2,998); 11,402 6 per cent. non-cumulative preference shares of £10 each, fully paid (Nos. 2,999 to 14,400); and 27,050 ordinary shares of 1s. each, fully paid (Nos. 20,001 to 47,050), in lieu partly of the 10,852 ordinary shares now quoted.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of 5 per cent. 50-year mortgage bonds of £100 each.

The Committee have appointed special days as under :—

August 16th.—Adelaide Electric Supply Co.—£100,000 5 per cent. debenture stock.

Mexican Northern Power Co.—Scrip, fully and partly paid, for $4,500 5 per cent. first mortgage 30-year gold bonds.

Wednesday, August 30th.—British Insulated and Helsby Cables, Ltd.—£200,000 5 per cent. mortgage debenture stock.

And ordered the undermentioned securities to be quoted in the Official List :—

Shawinigan Water and Power Co.—Further issue of £205,480 4½ per cent. perpetual consolidated mortgage debenture stock; $500,000 additional common stock; and $250,000 additional 5 per cent. consolidated first mortgage bonds for $1,000 each (Nos. 901 to 1,050, and 1,694 to 1,793).

Adelaide Electric Supply Co.—£100,000 5 per cent. debenture stock.

Bombay Electric Supply and Tramways Co.—Further issue of £30,000 5 per cent. second mortgage debentures of £100 each, Nos. 1,701 to 2,000.

Chile Telephone Co.—Further issue of 22,000 shares of £5 each, fully paid, Nos. 44,001 to 66,000.

Mexican Northern Power Co.—Scrip, partly paid, for $4,500,000 5 per cent. first mortgage 30-year gold bonds.

Montreal Water and Power Co.—Further issue of £20,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 6,982 to 7,001, and 7,498 to 7,617.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended June 30th, 1911, were 1,059,023, compared with 995,992 units in the corresponding five weeks of 1910.

MARKET QUOTATIONS.

Wednesday, August 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£12 10	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£24	..
a „ White Sugar	„	£22 15	..
a „ Peroxide	„	£33	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n casks	per lb.	5½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	5½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70 %) ..	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b „ Wire, in ton lots ..	„	£102	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£8[5] to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	7½d.	½d. inc.
c „ Tube (brazed)	„	8½d.	..
c „ „ (solid drawn) ..	„	7d.	..
c „ Wire, basis	„	8¾d.	..
c Copper Tubes (brazed)	„	9¾d.	..
c „ „ (solid drawn ..	„	8½d.	..
c „ Bars (best selected) ..	per ton	£71	..
c „ Sheet	„	£71	..
c „ Rod	„	£71	..
e „ (Electrolytic) Bars ..	„	£78 10	5/- inc.
e „ „ Sheets ..	„	£74 10	10/- inc.
e „ „ Rod ..	„	£61 10	..
e „ „ H.C. Wire	per lb.	7½d.	..
f Ebonite Rod	„	5/8	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
h Gutta-percha, fine	„	8/6	..
h India-rubber, Para fine	„	4 6½	½d. dec.
j Iron Pig (Cleveland warrants) ..	per ton	47/3½	1½d. inc.
j „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£14 10	5/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9	..
d Mica (in original cases) small ..	per lb.	6d. to 2s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	2½d.	..
r Steel Magnet, in bars	per ton	£56	..
g Tin, Block (English)	„	£190 to £192	£3 dec.
n „ Wire, Nos. 1 to 18	per lb.	2/1	..
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh's (Vieille Montagne bnd.)	„	£22 5	£2 5 inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Asbby, Ltd.
l Richard Johnson & Nephew, L
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Dublin and Lucan Electric Railway Co.—The directors' report to June 30th, 1911, states that the gross receipts for the half-year from all sources amount to £3,456, a decrease of £6 on the corresponding period of 1910, whilst the expenditure has increased by £277, mainly in coal and repairs to plant. After providing for debenture interest, there is an available balance of £920, out of which the directors recommend the payment of the usual half-yearly dividend on the 5 per cent. preference shares, which will absorb £475, and the balance of £445 is to be carried forward to next half-year.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum for the half-year ending July 31st, 1911, on the share capital. The dividend is payable, less income-tax, on August 31st.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books and register of members will be closed from 18th to 31st inst. for the preparation of warrants for dividends payable 31st inst.

STOCKS AND SHARES.

Tuesday Evening.

Markets in the Stock Exchange have been, and still are, passing through a period more exciting than remunerative. The various developments of the great strike, with their startling changes, have caused prices in the Home Railway market and several other sections to sway violently. To-night (Tuesday evening) the situation is thought to be clearer, but what it may be before these lines are in print it is, of course, impossible to say.

Changes in the Electrical Railway department are of no great consequence. Central Londons remain weak, although they show no further falls. City and South London Ordinary shed 1½. Metropolitans and Districts are both decidedly lower. Underground Electric Railways 6 per cent. income bonds dropped 3 points, but for this there was the excuse that the recent statement is considered disappointing in view of the small dividend declared on these securities. One of the Home Railway stocks to suffer most has been Brighton Deferred, the price slumping to par, from which it had a smart recovery of about a point.

The Home Traction and Tramways division shows falls of ½ in British Electric Traction Ordinary, and of $\frac{1}{16}$ in Bath Tramways Preference. London United Tramways Preference are easier, the price having been put down because it was feared that the grave disaffection of tramwaymen in Glasgow might be reflected in London; nor did the settlement of the Glasgow dispute help to restore the lost fraction from London United shares. Dublin United Preference are nominally harder by reason of the quotation being narrowed, but actually there is no change in the price.

Rio Trams have been fluctuating considerably, although on balance there is no alteration. Sao Paulo Trams show a loss of 2 points, and Capes are $\frac{1}{16}$ off. The Canadian-Latin group is fairly hard, but Northern Light and Power Bonds have started falling again, and there is a fall of 5½ in Montreal Light and Power shares, from which it may be inferred that the rumoured amalgamation scheme is, at all events, hanging fire. Shawinigan capital stock is ½ lower, and the Mexican issues are also a trifle down, with the exception of Mexico Tramways 5 per cent. bonds, which have hardened to par.

English Electricity Supply shares remain very steady, the interim dividend announcements keeping the markets hard. City of London Ordinary rose ½, while a similar fraction has been lost by St. James's Ordinary. Edmundson's went back to a slight extent, and other prices in the catalogue are practically unchanged.

Telegraph issues show a goodly list of improvements. The latent strength of the market has been manifest for some time past in the steady way in which prices have appreciated. Now, there appears to be very little floating supply of stock, and the difficulty of getting hold of prior-charge descriptions is on the increase. Eastern Extension shares have gained ½, although Eastern Telegraph Ordinary remained stationary. Anglo-American Telegraph Deferred fell ½ on account of a sharp slump in American Rails.

That same weakness in Wall Street resulted in further depression of the Mackay Companies' stocks and American Telephone and Telegraph capital stock. New York has been shaken rather badly by financial, labour and other troubles, with the result that most American stocks have given way substantially.

Speculation in Marconis formed the reason for a sharp dip in the price to 44s., but there appear to be eager buyers of shares on any relapse, and the price was quickly taken up again to 46s. 6d., at which the market continues to look a decidedly good one. National Telephone Deferred went back 1½, but the Preferred rose a point.

The Manufacturing list is steady. Babcock's have commenced to recover, and are $\frac{1}{16}$ up. Henley's Preference are also a good market, and the Debenture stock has been in some request. Telegraph Construction receded 10s., but the Debenture stock shows a point gain. Rubber has been coming down a little, and consequently rubber shares, besides being a very dull market, are mostly easier.

Crossley Bros., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum on the ordinary shares for the half-year to June 30th.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, free of income-tax, for the half-year ending June 30th last, both payable September 1st.

Melbourne Tramway and Omnibus Co., Ltd.—The directors have declared a bonus for the year to June 30th at the rate of 5 per cent. (6d. per share).

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10½ —10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7¾— 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞— 4⅜	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 5⅛	..	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞— 4½	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12½— 12¾	+ ⅛	5 9 10
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½— 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅜— 7⅝ xd	..	6 7 0
Do. 6 % Pref.	10	6	6	11 — 11½ xd	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	½— ⅝	— 1/16	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2¼— 2⅝	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	5½	6	4¼— 4⅝	..	6 6 4
Do. 5 % Cum. Pref.	5	5	5	4¼— 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Hove	5	8½	9	6⅞— 7⅛	..	6 4 2
Kensington & Knightsbridge, Ord	5	8	9	6⅞— 7⅛ xd	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	79 — 83	+ 1	5 8 5
London Electric, Ord.	8	2	2	1⅝— 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅝— 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅞— 4⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3¾ % Mort. Deb.	Stock	3¾	3¾	84½— 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½— 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3⅜— 3⅞ xd	..	5 8 5
Do. 5 % Pref., Non. Cum.	5	5	5	3½— 4⅛ xd	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	..	..	..
Oxford	5	7	7½	6⅜— 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8½— 9⅜ xd	— ⅛	5 6 8
Do. 7 % Pref.	5	7	7	6⅞— 7⅛ xd	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84½— 86½	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜— 1½	..	Nil
South London, Ord.	4	5	5	2⅜ — 3	..	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½—101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜— 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	¾— 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2⅜— 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7⅞— 8½	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	5— 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½— 5⅝	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅝— 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	110 —115	..	6 1 9
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	2	3	¾— ⅞	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½— 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	87 — 89	+1	5 12 4
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16— 3/16	..	..
Do. 6 % Pref.	1	6	6	13/16— 15/16	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	2⅜— 3	— ⅛	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89½— 90½	— ½	5 10 6
Mexican Lt. & Power, Common	$100	4	4	89 — 91	..	4 9 0
Do. 7 % Cum. Pref.	$100	7	7	110 —112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	97 — 98 xd	— 1	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½— 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	6	7	165 —170 xd	—5½	4 2 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	43 — 45	—2	11 2 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	116½—118½	— ½	3 7 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	1⅛— 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	+1½	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜— 7⅞	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98½—100½	+ ½	4 19 6
American Telep. & Teleg., Cap.	$100	8	8	137 —139	—2	5 15 1
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅜	3⅜	67 — 69 xd	..	5 8 8
Do. 6 % Pref.	Do.	6	6	111½—112½ xd	..	5 6 8
Do. Def.	Do.	25/-	30/-	25⅜— 25⅝	— ⅛	5 15 11
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101½—103½	+ ½	4 16 7
Chili Telephone	5	8	7	6⅛— 7⅛ xd	..	4 18 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	87⅛— 89⅛	..	4 9 5
Cuba Telegraph	10	6	6	10⅛— 11	..	5 9 1
Do. 10 % Pref.	10	10	10	17⅝— 18½	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅞— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜— 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	100 —102	+1	4 8 3
Direct United States Cable	10	4½	4½	8 — 8½	+ ⅛	5 5 11
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	+1	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	102 —104	+ ⅛	3 16 11
Eastern Extension	10	7	7	13⅜— 13⅝	+ ⅛	5 0 11
Do. 4 % Deb.	Stock	4	4	100½—102½ xd	+ ½	3 18 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	100 —102	+ ½	3 18 5
Globe Telegraph and Trust	10	5⅞	5⅞	10⅞— 11⅛	..	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½— 58½	..	5 11 1
Mackay Companies Common	$100	4	5	86 — 88	—2	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	72 — 74	—3	5 8 1
Marconi's Wireless Telegraph	1	Nil	Nil	2⅛— 2⅜	..	..
Monte Video Telephone, Ord.	1	6	6	⅞— 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	104 —106 xd	+1	5 13 2
Do. Def.	Do.	6	6	117½—120½ xd	—1½	4 19 7
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜ xd	..	5 11
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜ xd	..	5 11
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛— 5⅜ xd	..	4 7 1
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10
Do. 4 % Deb.	Do	4	4	98 —100	..	4 0
New York Telep., 4½% Gen. Bnds.	100	4½	4½	102½—103½	+ ¼	4 7 0
Oriental Telep. and Elec.	1	8	8	1⅞— 1⅞	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅜— 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	+ ½	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½—101½	+ ½	3 18 10
Reuter's	8	5	5	8⅜— 9½	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131½—134½	+ ½	4 9 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —100	+ ½	4 9 1
United River Plate Telephone	5	8	8	7⅞— 7⅞ xd	..	5 5 10
Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅜	..	4 10 11
West Coast of America	2½	2½	2½	1⅜— 1½	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	+ ½	4 0 0
West India and Panama Teleg.	10	Nil	¾	2⅝— 2⅞	..	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜— 10⅝	..	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9⅝— 10⅛	..	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅜— 14⅜	..	4 18 3
Do. 4 % Deb.	Stock	4	4	100 —102	+ 1	3 18 5
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	*	Nil	Nil	⅛ — ⅝	.	Nil
Do. 5 % Pref.	1	5	5	⅜ — ⅝	−1/16	6 13 4
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1½	— ⅛	Nil
Do. 6 % Pref.	10	1½	1½	3⅞ — 4¼	..	3 10 7
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	68 — 70	..	4 5 9
Do. Pref.	100	4	4	87 — 89	..	4 9 11
Do. Def.	100	2	2	49 — 51	..	3 18 5
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 11
City & South London, Ord.	100	1½	1½	29½—30¼ xd	−½	4 18 4
Do. 5 % Pref., 1891	100	5	5	108 —110 xd	..	4 11 0
Do. Do. 1896	100	5	5	104 — 106 xd	..	4 14 4
Do. Do. 1901	100	5	5	103 —105 xd	..	4 15 3
Do. Do. 1903	100	5	5	102 —104 xd	..	4 16 2
Do. 4 % Deb.	100	4	4	102 —104	..	3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12½— 13¼	+ ¼	4 10 7
Great Northern & City, Pr'f. Ord	10	Nil	Nil	⅝ — 1⅛	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	.. — ..	..	Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80	..	5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1½	2½	2⅜ — 2⅝	..	4 10 11
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82	..	6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	8¼ — 8⅝	— ¼	Nil
Do. 4 % Deb.	100	4	4	73 — 76	..	5 5 3

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1	1⅜	44⅜— 45½ xd	—1½	3 0 9
Do. Surplus Lands	100	2⅜	2½	66 — 68 xd	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	92 — 4	..	3 14 6
Do. 3½ % Pref.	100	3½	3½	88 — 90 xd	..	3 17 9
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89 xd	..	3 18 8
Metropolitan District Ord.	100	Nil	Nil	25⅜ — 26½	—1	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	Nil	3½	90 — 92	..	3 10 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5½	⅜ — 1 1/16	..	5 6 8
Do. Def.	1	Nil	Nil	⅛ — 7/16	..	Nil
Do. 5 % Pref.	1	5	5	⅜ — 1 3/16	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	102½—104½	..	4 15 8
Potteries, Ord.	1	2	2	3/16 — 5/16	..	..
Do. 5 % Pref.	1	5	5	5/16 — 7/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	6	⅛ — ⅜	..	10 3 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15 5
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18 6
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	1	61 — 63	—3	1 11 9
Do. Power House Debs.	100	..	4	101 —103	..	3 17 8
Yorkshire (West Riding), Ord.	5	Nil	Nil	¼ — ⅜	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5⅛— 5⅝	..	5 3 6
Do. 2nd Pref.	5	5	5	4 1/32— 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜— 11¼ xd	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96½— 98½	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	97 — 99	+ ½	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	6¼ — 7	..	5 14 4
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	..	5 10 4
Do. Pref. Ord.	100	6	6	119 —123 xd	..	4 17 7
Do. 5 % Pref.	100	5	5	106 —119	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	102½—104½	..	4 6 2
Calcutta Trams, Ord.	5	4½	6	5⅜ — 6⅜	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	7/16 — ⅝	— 1/16	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102	..	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	92½— 95½	..	5 4 9
Do. 6 % B Deb.	100	6	6	63 — 67	..	7 9 3

La Plata Elec. Trms, Prf.	1	6	6	⅛— 1 1/16	..	5 13 0
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	97 —101	..	4 19 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	..	4 18 0
Mexico Trams Com.	$100	7	7	120½—122½	..	5 14 3
Do. Gen. Con. 5 % Bonds	..	5	5	99½—100½	+ ½	4 19 6
Do. 6 % Bonds	100	6	6	99 —101	..	5 18 10
Para Elec. Rlys. & Lt., Ord.	5	..	10	7⅛ — 7½	..	6 13 4
Do. 6 % Pref.	5	6	6	5⅜ — 5⅝	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	⅜ — ½	..	..
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅝ — 5⅞	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	+1	4 9 1
Rio de Janeiro Trams	$100	1	4½	116 —117	..	4 5 6
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	97⅜— 98¾	..	5 1 3
Sao Paulo Tram, Lt. and P.	$100	10	10	178 —181	—2	5 10 6
Do. 5 % 1st Deb.	$500	5	5	103 —105	..	4 15 3
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 98 xd	..	5 2 0
Un. Elec. Trams Monte Video	5	5	6	5⅛ — 6	..	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4 2 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	⅝— ¾	..	Nil
Do. 6 % Pref.	1	12	9	11— 11½	..	7 7 8
Babcock & Wilcox	1	24	26	5⅝— 5 7/16	+ 1/16	4 15 7
Do. Pref.	1	6	6	1⅜— 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6¾— 7⅛	..	6 15 7
Do. Pref.	5	6	6	5¾— 6¼ xd	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1½— 1 15/32	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	⅛— ¼	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅜— ½	..	Nil
Do. 4½ % Deb.	100	4½	4½	58 — 63	..	7 2 10
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9½	..	7 18 0
Do. Pref.	5	5	5	4¾— 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	34— 38	..	4 17 0
Do. Deb.	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co.	3	Nil	Nil	⅛— ⅜	..	Nil
Do. Deb.	100	5	5	57½— 67½	..	7 8 2

Dick, Kerr	1	6	5	⅛— ⅛	..	5 6 8
Do. Pref.	1	6	6	1 1/32— 1 1/32	..	5 9 7
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	⅜— ½	..	Nil
Do. fully paid	5	Nil	Nil	1¼— 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 8
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	2½	⅛— ⅜ xd	..	6 3 0
Do. Pref.	2	7	7	1⅛— 1 3/16 xd	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7½— 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8¾— 9	..	5 11 1
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12¾— 12⅞	..	5 16 6
Do. Pref.	5	4½	4½	4 1/32— 5⅛	+ 1/16	4 6 9
Do. Deb.	100	4½	4½	106½—108½	+ ½	4 2 11
India-Rubber, G. & T.	10	10	10	11½ — 13½	..	7 8 2
Do. Pref.	10	5	5	9⅞ — 10½	..	4 16 5
Telegraph Construction	12	17½	20	34½ — 36½	— ½	6 11 7
Do. Deb.	100	4	4	100 —102	+1	3 18 5
Willans & Robinson	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. Pref.	5	1½	Nil	⅜— 1	..	Nil
Do. Deb.	100	4	4	55 — 66	..	6 3 1

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

ELECTRIC HEATING AND COOKING IN THE UNITED STATES NAVY.

It is not so long ago that we were accustomed to look upon electric heating and cooking as an expensive luxury hardly to be contemplated as a serious economic possibility, and it is therefore of more than ordinary interest to notice that the Navy Department of the United States has taken a most significant step in relation to the equipment of electric ranges and baking ovens on board the men-of-war of America. By the courtesy of the Secretary of the American Navy we are enabled to give some particulars of a report made by a board of Navy officers upon the subject, and the specifications and plans issued at the latter end of 1910 upon which such electrical apparatus are to be constructed. It is impracticable to give the report in full, but, in general terms, the substitution of the electrically-heated for the coal-burning units is recommended, on the score of cleanliness, convenience, improved hygienic conditions, and efficiency, where the necessary electrical energy is available. The No. 1 baking oven is capable of baking about 1,000 loaves of bread in 20 hours, and the No. 2 oven a proportionate number. The efficiency of the electric ranges, as compared with the several types of coal-burning ranges, is in the ratio of two of the former equalling three of the latter. The electric range is also slightly less expensive to operate.

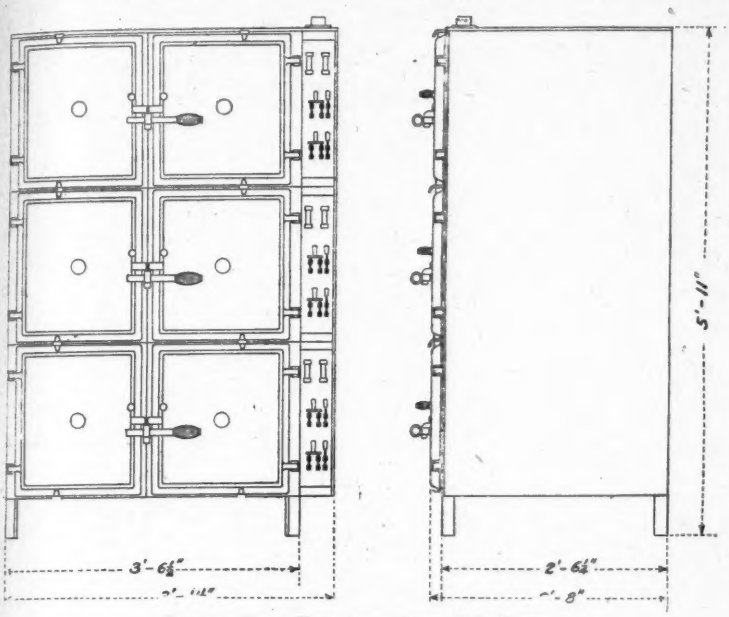


Fig. 1.—No. 1 Electric Oven; U.S. Navy.

We will deal first of all with the ships' electric baking ovens numbered "1" and "2." No. 1 oven accommodates 12 United States standard bread pans (each pan is 27 in. long, 16 in. wide, and 4 in. deep) in two rows, each six shelves high, and the No. 2 oven accommodates eight United States standard bread pans in two rows, each four shelves high. The general construction is in accordance with the side and end elevation, shown in fig. 1. It is divided into three baking chambers. The limiting dimensions (in inches) are:—

	No. 1.	*No.* 2.
Overall width not to exceed	48	48
Overall depth not to exceed	36	36
Overall height not to exceed	72	62
Inside width of each baking chamber not less than ...	38	38
Inside depth of each baking chamber not less than ...	28	28
Inside height of each baking chamber not less than ...	15	15

The switch panel is kept within the limit of the edge of the frame. All exterior sheet metal parts are of galvanised sheet iron 0·034 in. thick, and all interior sheet metal parts of sheet iron 0·025 in. thick. The oven rear frame is built up of 2-in. angle irons. The horizontal edges of the oven are stiffened by angle irons; the vertical angles extend below the bottom of the oven to serve as the supporting legs. The oven front frame is built of malleable iron castings forming the openings of the oven chambers and having angle irons extending downwards to form feet.

The baking chamber is distinct and separate from the heating chamber, and there are openings between them which permit of the circulation of air, 2 in. above the bottom of the baking chamber, so that the spilling of material cannot overflow into the heating chamber or contaminate the heating elements. The bottoms of the baking chambers are stiffened by reinforcing pieces of angle iron, securely riveted on to the underside, and having the rivet heads flushed with the bottoms. The tops of the baking chambers are horizontal, having the front edges stiffened by angle irons. Four pan racks are provided for each baking chamber. Suitable slides for the racks are securely riveted to the inside of the baking chamber at equal intervals apart. Each baking chamber is fitted with two doors hinged at the sides and giving the clear opening of the full width and height of the baking chamber, each door being double and the intervening space filled with heat-insulating material. Both doors of each baking chambers are closed by a single springless drop latch secured to the right-hand door and overlapping the edge of the left-hand door sufficiently to firmly secure it. Each door is provided with a device to secure it in the open position when required. The oven is double walled throughout, the intervening space being filled with heat insulating material having a thickness of not less than 1¼ in. The walls between the baking chambers are lagged in the same manner, so that each baking chamber may be independently operated with efficiency.

The heating elements and their terminal blocks are placed in heating chambers, which are distinct and separate from the baking chambers, so as to be entirely protected from mechanical injury from dirt, grease, and from the contents of the oven, and the heating units are easily removable from the front of the ovens. No. 1 oven is equipped with 12 heating units; No. 2 oven with eight. Each baking chamber has two units at the top and two at the bottom. The arrangement of the unit terminals is such that when the unit is pushed into place, the terminals automatically align with the proper clips in the terminal block. The clips in the terminal block are electrically connected to a two-heat regulating switch. The regulating switches are conveniently mounted in a compact group, each switch plainly indicating the baking chamber which it controls. These switches are protected from the influence of the hot air rising from the oven. Suitable enclosed fuses for the protection of the various units are mounted in conjunction with each chamber. Provision is made for the enclosure of all wiring to these switches, and also for running conduit directly into the casing of the oven and making connection with the main leads from the ship's circuits. Switches and fuses are so mounted as to protect them from hot water falling or dripping from above. The heating coils are of metal, having a specific resistance of not less than 570 ohms per mil-ft. at 75° F., and a melting point of not less than 2,200° F., and capable of running at 1,350° F. without detrimental oxidisation, and it is provided that the distribution of heat shall be even under all operating conditions. The heating units are so arranged that the air circulating in the interior of the baking chamber will come into direct contact with the wire which carries the heating current.

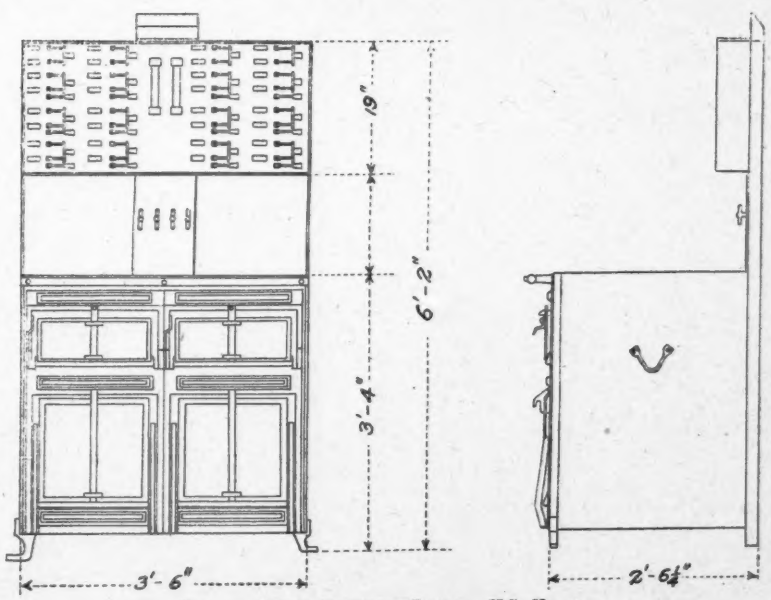


Fig. 2.—Ship's Electric Range; U.S. Navy.

No combustible material, or material which will deteriorate with the heat generated, is used in the construction of all the heating units. No. 1 oven is provided with six two-heat switches for controlling the current input in the top and bottom units of the three oven chambers respectively. No. 2 oven is provided with four two-heat switches for the same purpose. The wattage for each baking chamber is sufficient to maintain a baking temperature of 500° F. All exterior unfinished sheet metal parts are finished with two coats of black asphaltum paint; all other unfinished metal parts receive two coats of flat black. Each oven has to stand a dielectric test of 1,000 volts alternating current when hot with all current carrying parts in circuit, and must be capable of running without injury at 50 per cent. overload for 30 minutes.

The requirements for the ship's electric ranges are somewhat similar. Each range comprises two ovens, two broiling compartments (which can also be used as warming ovens), and eight stoves or hot plates, and have the general construction shown in fig. 2. The limiting dimensions specified are:—Overall width, not to exceed 42 in.; overall depth not to exceed 36 in.; overall height not to exceed 78 in.; height of stove tops not to exceed 40 in.; inside width of ovens, not less than 18 in.; inside depth of ovens not less than 28 in.; inside height of ovens not less than 16 in.; each broiling surface not less than 18 × 24 in.; top of each stove not less than 9 × 12 in.; size of switch panel about 19 × 42 in. (not to extend beyond edge of frame). Net weight of range, complete, about 1,000 lb. (not to exceed 1,200 lb.).

The main back frame of the range is built up of vertical angle iron 2 in. × ¼ in., stiffened by horizontal angle irons 1 in. × 1 in. × ⅛ in., the vertical angles to extend 4 in. below the bottom of the range to form feet. The main front frame is built up of malleable iron castings, forming the front openings of the ovens and boilers, and extending downward to form feet. All interior sheet-metal parts are of 0·025 in. thick sheet iron, the exterior side sheets being of 0·034 in. thick galvanised sheet iron, and the exterior back sheet being of $\frac{1}{16}$ in. thick galvanised sheet iron. The sides, top and bottom of the oven are flush with the opening, so that the oven can be easily cleaned out. The oven chamber is distinct and separate from the heating chamber for the same, and the opening between them, which permits the circulation of air, is at least 2 in. above the bottom of the oven chamber, so that any material spilled can not overflow into the heating chamber or contaminate the heating elements. The bottoms of the oven chambers are stiffened by reinforcing pieces of angle iron, securely riveted on the underside, and having the rivet heads flush with the bottoms. Two pan racks are provided for each oven. Suitable slides for these racks are securely riveted to the inside of the oven. Each oven is provided with a flue controlled from the top of the range, and is fitted with a door arranged to open downward, and when open to rest horizontally and flush with the oven bottom, so as to form a continuation of it, and to be capable when in this position of supporting a weight of at least 150 lb. without distortion. Each door is closed with a single springless drop latch.

The ovens are double walled throughout. The intervening space is filled with heat-insulating material, having a thickness of not less than 1¼ in. This applies to the space between the ovens as well as around them. The heating elements and their terminal blocks are placed in heating chambers, which are distinct and separate from the oven chambers, so as to be entirely protected from mechanical injury, from dirt grease, and from the contents of the oven. The heating units are easily removable from the front of the range, and each oven is equipped with two heating units, one at the top and one at the bottom. The arrangement of the unit terminals is such that when the unit is pushed into place the terminals automatically align with the proper clips in the terminal block, and the heating units are so arranged that the air circulating in the oven chamber will come in direct contact with the heating unit. The wattage for each oven is sufficient to maintain a temperature of 500° F. within the oven when empty.

Each broiling chamber is provided with a rack or grill 18 in. wide × 24 in. long, and also a grease pan 18 in. wide and 24 in. long, so arranged as to protect the grease from extreme heat. Provision is made for adjusting the distance of the grill from the heating element. The broiling unit is located at the top of the broiling chamber, and is of the radiant heat type, protected from mechanical injury. The actual supports for the coils forming the heating element of the broiler units are of metal, so as to obviate the possibility of breakage due to excessive change in temperature. Each broiler is provided with a flue controlled from the top of the range, and the broiler heating units are easily removed from the front of the range. The arrangement of the broiler unit terminals is such that when the unit is pushed into place the terminals will automatically align with proper clips in the terminal block. Each broiler compartment is fitted with a tight door, arranged to open downward, and when open to rest horizontal and flush with the compartment bottom, so as to form a continuation thereof, in order that the broiler compartment may be used as a warming oven if desired, in which case it obtains its heat from the oven below it. The stoves or hot plates, of which there are eight on each range, are so arranged that they can easily be removed by lifting out of place, and as easily replaced. The terminal bars on the stoves automatically make contact with the terminal clips on the contact blocks attached to the range. The stoves are of cast-iron having flat tops stiffened at the edge by a downwardly projecting flange, and the wattage of each stove is sufficient to produce a temperature not less than 750° F. at the centre. The flues for the ovens and broilers, and the dampers controlling the same are situated at the back of the range. Each oven is controlled by two two-heat switches, one controlling the top unit and one the bottom unit. Each broiler is controlled by one single-heat switch, and each stove is controlled by one two-heat switch. Each switch is provided with a name-plate of brass, having white letters engraved upon a black background designating its purpose.

Suitable enclosed fuses for the protection of the various units are mounted in conjunction with each switch. Provision is made for the enclosure of all wiring to these switches, and also for running conduit directly into the metallic casing behind the switch panel of the range for making connection with the main leads from the ship's circuits. Switches and fuses are so mounted as to protect them from water falling or dripping from above. Special care is taken that there is no exposed wiring in the vicinity of the electric range. The heating coils throughout are of metal, having a specific resistance of not less than 570 ohms per mil foot at 75° F. and a melting point of not less than 2,200° F., and capable of running at a temperature of 1,350° F. without detrimental oxidisation. The temperature of each unit has to be practically uniform throughout its coils under all operating conditions, and no combustible material, or material that will deteriorate with the heat generated, can be used in the construction of the heating units.

Unless otherwise required, the ranges are designed for 120 volts D.C. The finish of the ranges is the same as that described above for the ovens, and each range has to stand a dielectric test of 1,000 volts alternating current when hot with all current-carrying parts in circuit. The ovens are capable of running without injury at 50 per cent. overload for 30 minutes, and the stoves and broilers at 25 per cent. overload for 30 minutes. One complete heat unit of each type is furnished with every five or less ranges installed on any vessel, as spares, and one set of spare fuses is furnished with each range.

It will be seen from the foregoing description and illustrations that the question of electric baking and cooking has received an amount of detailed attention from the United States Navy Department that sufficiently indicates the importance of electric heating as it appeals to them. It would appear that an equally earnest consideration of the subject would well repay not only our own Admiralty, but also the managing boards of our large public institutions, such as infirmaries, schools and workhouses, where the preparation of wholesome meals in large quantities is a matter of such vital importance.

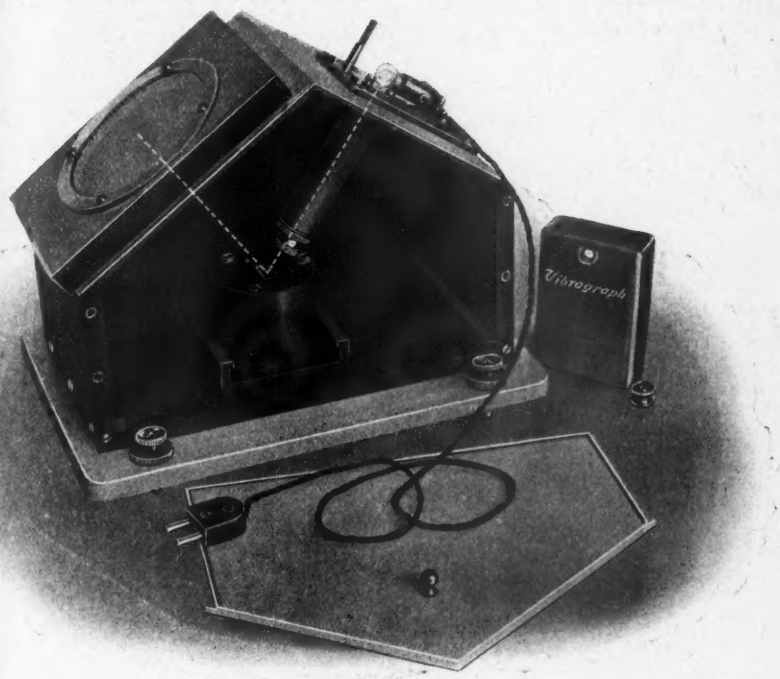
The Vienna Technical Museum.—We have received a circular stating that in commemoration of the sixtieth anniversary of Emperor Francis Joseph's reign, Austrian manufacturers, with the assistance of the State and the City of Vienna, initiated this new Museum. The foundation stone was laid on June 20th, 1909, and the building which covers an area over 20,000 sq. yd., and which is situated opposite the palace of Schoenbrunn, is now nearing completion, and will be a lasting monument of the monarch. The Museum is intended to demonstrate the development of industries and crafts in historical succession, also to do justice to the technical achievements of the present day, and to promote progress in this line by periodical exhibitions. It is to be a public educational centre spreading the knowledge of the scientific foundations and the national economic aims of technical pursuits. A considerable stock of objects has already been secured, as several large and valuable State collections are shortly to be brought together there. There are, however, many links in the chain of technical development still missing. Therefore, technical scientists, manufacturers, and craftsmen of all countries are invited to co-operate with the Museum authorities in procuring and selecting suitable objects. Everything pertaining to technical labour is acceptable, principally tools, machines, apparatus, models, materials, methods of working, finished articles, as well as plans, designs, books, illustrations and manuscripts. The Austrian Government has placed at the Museum's disposal the spacious halls of the Rotunde ("Prater") for the receipt and sorting of contributions. The names of donators will be inscribed on the gifts and in a memorial book. Further particulars can be obtained from the office of the Technical Museum, Vienna, I. Ebendorferstrasse 6.

The London and North-Western Railway Coronation Illuminations.—The decorations and electrical illuminations in connection with the Coronation, the Royal visit to Ireland, and the Investiture ceremonies, carried out by the London and North-Western Railway Co. were on a considerable scale. We have received some interesting photographs of the night effects. The first shows the company's office buildings in Parliament Square, S.W., for the illumination of which 5,000 lamps were in use. The second photograph is of the company's steamer *Scotia*, lying in the Menai Straits, illuminated for the Investiture of the Prince of Wales at Carnarvon. The company's steamers *Anglia*, *Cambria*, and *Hibernia* were also illuminated. The *Scotia* was berthed at Spithead for the Naval Review. In addition to the above, illumination schemes were carried out at Euston, Piccadilly Circus, Birmingham, Liverpool, Dublin, Carnarvon and Holyhead. Altogether the company had some 15,000 electric lamps in use for the illuminations. All of these schemes were prepared and carried out under the supervision of the chief electrical engineer to the company, Mr. F. A. C. Leigh.

Bowls at Blackpool.—The championship of the Blackpool and District Municipal Officers' Bowling League was decided on August 10th, the electricity department being defeated by the cleansing department by 58 points to 39. At the close of the game the trophy and prizes were presented to the winners by Mr. C. Furness, electrical engineer and tramways manager. Mr. Furness also presented the prize to the winner of the individual handicap decided in the previous week.

THE VIBRAGRAPH.

The influence of vibration in connection with the increasing stresses with which the engineer of the present day has to deal, is nowadays receiving full recognition. It is only necessary to recall the problems of accurate balance connected with high rotative speed, such as have revealed themselves in the use of the steam turbine in both buildings and ships; the problems of moving loads on bridges, and the tremours produced by tramways and railways.



Transport Case, 13⅛" × 9⅝" × 8⅝" high; weight, with three mercury cups, two dry cells, six dark slides and transport case, about 24 lb.

Vibragraph with Side and Lamp Cover Removed showing Path of Beam of Light.

In all such cases the actual vibration has been a vague quantity and definite measurement a matter of difficulty.

However, Messrs. Siemens Bros. & Co., Ltd., of Caxton House, have now introduced what appears to be a practical instrument for measuring and recording vibration in definite units, known as the Vibragraph. It is accurate and gives records showing actual movements magnified at least 100-fold.

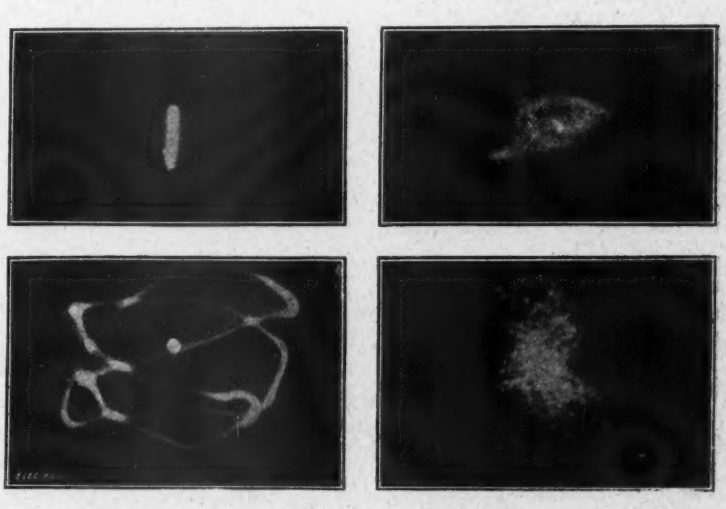
Our first view illustrates the complete instrument, in which a mercury cup is provided with a floating mirror, so pivoted as to avoid lateral movement, and the mercury ripples caused by vibration result in an angular movement of the mirror. The beam of light emanating from the small glow lamp, and reflected by the mirror, will, therefore, record on photographic paper a straight line if the vibration is in one plane only, or a complex figure if the vibration be in planes at different angles, such as is nearly always the case in actual practice. When no records are required, the photographic paper can be replaced by a screen, thus permitting of direct visual observations. Each mercury cup has its own constants, and three different cups are usually supplied with the instrument so as to make the Vibragraph suitable for recording strong (say 0·3 mm.), medium (say 0·08 mm.) and small (say 0·02 mm.) vibrations. A set of calibration curves is supplied with each cup, which permit of the determination from the photographic record of the actual movement of the vibrating body in fractions of inches or millimetres.

It may be interesting to mention that the mercury cups, although so highly sensitive, require no special precaution in transport; they may be tilted and turned upside-down without detrimental effect.

The apparatus has been put to practical tests for over 18 months with most satisfactory results, and the tests that have been carried out include some for leading engineering firms in connection with high-speed turbo work; and for two large municipal electricity supply undertakings in connection with litigation in respect of alleged nuisance through transmitted vibration of the central station.

Turbo-Generator.
Scale: 1 in. = 4 mils, actual vibration.

Two-Crank Engine.
Scale: 1 in. = 175 mils, actual vibration



Scale: 1 in. = 77 mils, actual vibration.
Crank Casing of Engine Driving 1,250 k.v.a. Alternator at 188 r.p.m.

Scale: 1 in. = 20·6 mils, actual vibration.
4-Cylinder Motor Car, Stationary, Engine running De-clutched.

Typical Vibragrams.

BRITISH TRADE WITH MEXICO.

In recent reports on the trade of this district, H.M. Consuls at Vera Cruz and Tampico make some interesting comments which should be studied by our readers. These comments may not apply particularly to the electrical trade, but they will doubtless be of considerable value as showing the conditions which exist, and the mistakes which must be avoided. From the electrical point of view Mexico is a country of considerable importance possessing vast water powers, and the possibilities of supplies for electrical purposes do not appear to have been grasped by British firms, or if they have been grasped, attempts which have been made to secure the trade have not been very successful. Much is said nowadays by way of criticism of British manufacturers, and such criticism is not always justified, but in South and Central America particularly British enterprise is lacking, and foreign firms in many cases have worked to greater advantage, owing to their methods being more suited to these markets. In this respect it is gratifying to note that somewhat increased numbers of commercial travellers are now visiting Mexico in the interests of British firms, but it is stated that they express considerable surprise at the apparent lack of attention to the market.

The great defect of British firms in Mexico is their indiscriminate use of foreign merchant houses as the channels for their business; this is one reason why their trade is not larger than it is.

Some of the matters affecting trade with Mexico, which, although small, are extremely important, are dealt with by H.M. Consul in Vera Cruz as follows:—

"This Consulate receives during the year inquiries relative to an infinite number of subjects, such inquiries generally being accompanied by a certain amount of printed matter, which, I am sorry to say, more often than not is printed in English and gives the cost of the goods at some home port. This printed matter when in such shape is really of very little use, and it is surprising that those desirous of increasing their trade by correspondence do not add some kind of information whereby possible customers would know what an article would cost them delivered at this port, exclusive of Customs duties and landing charges. Exporters can readily ascertain approximately what these charges will be by applying to any steamship agency, who would inform them whether the particular

class of merchandise would pay freight on a weight or a measurement basis and the rates ruling at that time. (At the present there is very little fluctuation in ocean rates to Mexico, all the principal lines of steamers being in agreement on this subject.) While this would give the purchaser an idea as to the cost of the article he was buying, it would not necessarily mean that the ocean rates and charges quoted would be actually guaranteed. I would also call attention to the circumstance that this Consulate is frequently asked to undertake the distribution of trade circulars and printed matter compiled entirely in English. To do this properly would necessitate the translation of the major part of the papers or the sending of someone to explain to those in the trade the particulars of the object offered. This is quite impossible, as it would necessitate the employment of a large staff to attend to the requirements of all correspondents, and the men so employed would also have to be more or less experts in practically an unlimited number of trades. After many years' residence in this country, I am convinced that the only way of increasing trade is to send competent representatives as canvassers who can undertake probably two or three lines, bearing in mind that amongst other requisites essential to success is a knowledge of the Spanish language, which will conduce to a speedy acquaintance with the requirements and customs of the inhabitants of this country.

"I have often been told by leading dealers that they, as a rule, pay little or no attention to catalogues and other matter printed in foreign languages, especially where the weights and measures are not given in the metric system. In nearly every case the first question asked is, 'What will the goods cost me delivered in Vera Cruz?' Another point of trifling importance, but which seems to cause more irritation than the loss of a considerable sum, is the failure to put more than a 1d. stamp on letters destined to Mexico, whereas the postage from the United Kingdom, as everyone should know, is 2½d. Quite a number of letters are received at this Consulate in the course of the year insufficiently franked, and I might even mention one instance of this sort of thing. When replying to an inquiry I returned the envelope, in order to impress upon my correspondent the fact that I had to pay the overcharge; and although I received a letter of regret in reply, the said letter was also enclosed in an envelope with a 1d. stamp on it. Apparently while this is a small point, I wish to say that it is hard, perhaps, to realise the irritation that this causes, especially as in this country correspondence when insufficiently franked is held at the post office, and the person for whom it is destined is obliged to go to the post office, purchase the surcharge stamps, place them on the letter and obtain their cancellation before he can receive the correspondence, all of which is more or less loss of time for clerks or messengers.

"It is a matter of some surprise, too, that more use is not taken of the parcel post for the forwarding of samples and small packages instead of the very cumbersome system of turning goods over to a forwarding agent. For instance, a case was recently brought to my notice where a small parcel which if sent by parcel post would have cost the receiver about 8s. (with the double advantage that this would have covered delivery at any large town in the Republic), was sent through a forwarding agent, whose charges alone were much in excess of the total that would have been collected by the Post Office, and to this had to be added not only the steamship charges (always higher for parcels), but another agent's fee for clearing the goods at Vera Cruz, resulting in an expense to the consignee of upwards of £1 10s.

"The Chamber of Commerce at Vera Cruz is willing to accept articles for exhibition purposes in its rooms. The conditions and tariffs governing the same can be had on application to the Secretary, Camara de Comercio, Vera Cruz."

The Consul at Tampico writes:—

"The importance of good commercial travellers in opening up and extending trade relations is so generally acknowledged that it is needless to dwell on the subject. The representatives of British manufacturers, however appear to be much in the minority as compared with the representatives of American and German firms. Whilst some few British manufacturers are in the habit of having their travellers make periodical visits to Mexico, I generally find that these visits are so far apart that the trade is hard to hold. Mexican dealers, if they are satisfied with the goods they have previously purchased and with the general way they have been treated by the manufacturer, will often reserve their orders provided they know that the representative of the firm they have previously dealt with is likely to call upon them again before long. If the dealer does not know when the traveller is likely to return he will most likely place his orders with the representative of some other manufacturer who may happen to call and be able to produce an up-to-date line of samples. In making up an order the dealer is often greatly assisted by suggestions from the representative of the manufacturer, and it is to the interests of the manufacturer that any suggestions made by his representative should be *bona fide* and made with the view of assisting the merchant to increase and push his sales in certain lines. Cases have come to my knowledge where British manufacturers have expended large sums of money in sending out thoroughly efficient representatives to Mexico, who have introduced the articles manufactured all over the Republic and a good business has resulted. Unfortunately this trade has not been followed up, and the business, to secure which the manufacturer had expended a large sum of money, is being allowed to slip away. Manufacturers sending travellers out to Mexico should arrange for them to call on their customers at least once, if not twice, every year. In the interim let the manufacturer keep in touch with his customers by sending out monthly quotations printed in Spanish, leaflets calling attention to any changes or improvements in the goods manufactured, &c. The Mexican custom of sending out New Year's cards is not to be despised. I have known of several cases where business has resulted through the extension of this small courtesy, especially in the interior of Mexico.

"In cases where manufacturers do not wish to go to the expense of sending out a personal representative, I would suggest the establishment of commercial agencies in the most important business centres. At these agencies samples might be exhibited, and catalogues and general price lists furnished. The expense of running such an agency would be comparatively light if divided up between several different firms. The full working details of these agencies would, however, have to be carefully studied out by the manufacturers, and I would suggest that the Chambers of Commerce in some of our important manufacturing centres might be able to devise some practicable scheme for the establishment abroad of commercial agencies such as I have suggested."

PROCEEDINGS OF INSTITUTIONS.

Electric Traction in Switzerland.

By E. Huber-Stockar.

(*Abstract of paper read at the Zurich meeting of the* Institution of Mechanical Engineers, *July*, 1911.)

Electric traction on railways has occupied the minds of scientists and inventors as far back as the times of Faraday's memorable and fundamental discovery of the electro-magnetic mechanical production of electric current. In those times Davidson experimented with an electric locomotive on the railway between Glasgow and Edinburgh. His locomotive weighed about 5 tons; it had two axles, each driven by an electro-magnetic machine, and current was supplied from two of Sturgeon's primary batteries carried on the locomotive.

Electric railways proved to be an economic possibility where steam railways could no longer be financed. Especially in Switzerland, where living and manufacturing had become very expensive in the large towns, electric railways opened up agricultural and out-of-the-way districts for commercial enterprise, and furnished a system of communication by rail, thus completing and feeding the system of main line railways in a most beneficial manner.

Since 1890 electric traction has been adopted on one or another section of railway where steam traction appeared suitable.

At the present time a number of remarkable electrifications have been carried out, or are in course of completion, so that it is not necessary to waste words in justifying railway electrification as the subject of a paper to be read before a technical society, even not directly interested in electricity. The era of motors geared to driving axles, as in street cars, has probably passed as far as the more powerful vehicles are concerned, and the electric locomotive of to-day is, with regard to its mechanical part, to a large extent the work of the steam locomotive builder.

The reason for dealing more particularly with railway electrification in Switzerland is not because greater progress has been made in this direction, but because of the more general interest it presents in comparison with many other countries.

Though railway electrification in Switzerland is inseparable from the use of water power, and though this use is evidently beneficial to the financial situation of the country in the long run, still it must, for various reasons, be done in a way so as not to disturb the balance of traffic receipts on the one hand and the operating expense and interest on loans on the other. The time is still far distant when even State railways will be built, as the principal roads have been built all through the country and over the mountain passes, simply because they are necessary, no matter whether they are remunerative or not. Railways are still built and operated for the greater part, and most fortunately so, even by the State, on the basis of a commercial enterprise conducting a household of its own. Therefore, more particularly in Switzerland, where railways are, on the whole, not making profits because of cost of construction, heavy grades, rather irregular traffic, short average distance of travel, high wages, low fares and so on, the problem of railway electrification is in every case a problem mainly of general economics of railway operation, since the technical problem has admittedly been satisfactorily solved so far.

The electrifications of importance that have hitherto been or are being carried out are almost all either of an experimental or preparatory character, or were brought about by considerations not directly or purely economical. In Switzerland the economy of operation is having a decisive weight, which makes the problem, as it is presented, difficult.

In Switzerland, as in other countries, the railways already electrified, or about to be electrified in the near future, are such that smoke nuisance would be an almost prohibitive feature of steam, as in the case of the Simplon tunnel, or the capabilities of steam are near exhaustion, as in the case of the St. Gotthard Railway.

By railway is meant simply a line or system of lines of railway comparable with a steam railway line or system of lines of medium or great importance. This involves a somewhat high standard of construction of passenger and freight trains, of a certain weight and frequency, a traffic of a certain volume, and of a service of high responsibility. It excludes railway lines of a purely local character and smaller importance. There are in Switzerland only two gauges—1·435 m. "normal" (English standard) and 1 metre "narrow" to be considered. There are normal gauge interurban and branch lines similar to tramways, playing no *rôle* in the elec-

trification problem except as experiments, and there are narrow-gauge railways that are important in their district and in general, which run trains exceeding in weight that of many normal-gauge steam railways. These narrow-gauge railways must be included in the problem.

A table shows the slow progress of normal-gauge railways since about 1883 and the rapid progress of narrow-gauge railways since about 1887.

The extent of electric traction on rails in Switzerland, and particularly that of electric locomotive traction, is seen from Table I, compiled from the official statistics for 1909. Special attention is drawn to the improvement in the electrical percentage of normal-gauge railways at the present time—5·4 per cent. instead of 2·9 per cent. in 1909.

A comprehensive statement of the character of the principal railways is given in Table II.

Some of these railways are described in detail and illustrated.

Burgdorf-Thun (B.T.B.) Railway.—It is noteworthy that the first electric traction on a railway of the general character of normal-gauge railways of medium importance was on the alternate current principle using three-phase current. At the time of construction of the B.T.B., three-phase current was almost universally used for all power transmission and distribution over distances of some importance. The supply of electric power to the trains of the B.T.B., the terminal of which is Burgdorf, is over 50 km. distant from the source, where hydraulic power then was ready for use. Owing to the length of railway, 40 km., and the means then available, sectionising of the line was obviously necessary, 500 to 750 volts being then still the limit of electric-traction voltage considered necessary, and sub-stations were also required. According to the then practice, at least two such sub-stations with converting machinery under constant attention would have been necessary. The trains likely to be hauled were of a weight, and the grades of a length, not yet customary in electric-traction practice in general; the sub-stations would have become in size and cost both of plant and operation not compatible with the small average useful load of the few trains. Briefly, the problem of electrification, with its awkward features under average Swiss conditions, was set forth in the case of the B.T.B.

The adoption of three-phase current involved a compromise of advantages and disadvantages which are more or less evident. The advantages were: the elimination of costly sub-station plant and operation, and the reduction in investment or loss of power or both in the contact line, by making more sections of less length, supplied each with a simple transformer sub-station, the aggregate cost of which was far below that of even a much smaller number of converting sub-stations.

The disadvantages, on the other hand, were: a more complicated contact line composed of two contact-wires that were to be inter-

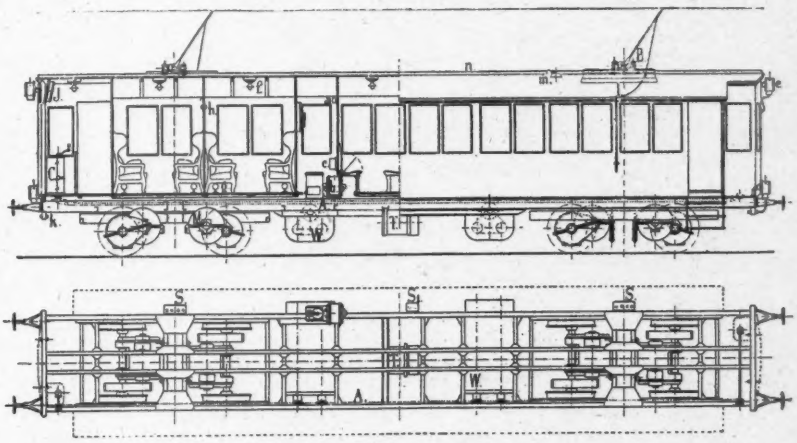


Fig. 1.—Motor Coach, Burgdorf-Thun Railway.

Number of axles, all driving ...	Two 4-wheel bogies.
Total weight equipped, empty	32 tons.
Number of seats	66
Weight of electric equipment	10 tons.
Diameter of wheels	1·020 m.
Motors, three-phase induction, rheostatic control for reduction of normal speed.	
Voltage of motors	750
Periodicity of alternating current	40
Power per motor, one hour rating	60 H.P.
Total motor power on car	240 H.P.
Gear ratio: single reduction	1 : 3
Normal pull on tread	1,800 kg.
Normal and maximum speed	36 km. per hour.
Contact: two-part bow.	
Brakes: compressed air.	

From the commencement there were two locomotives for dealing with freight trains of 100 to 150 tons weight; they could work

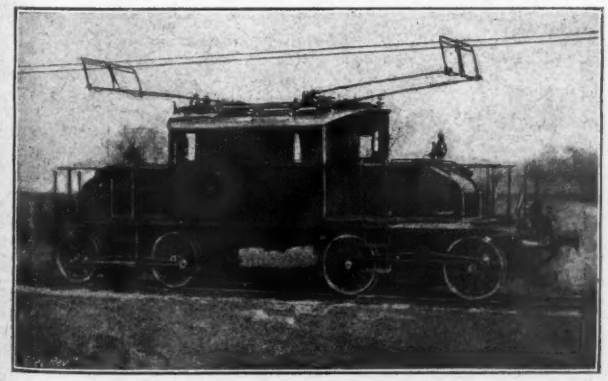


Fig. 2.—Three-Phase 800-h.p. Locomotive.

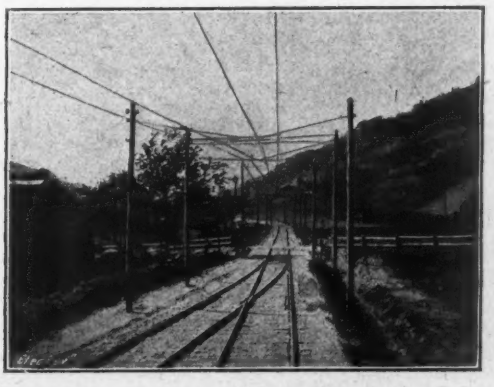


Fig. 3.—Three-Phase Overhead Work.
Burgdorf-Thun Railway.

insulated, difficulties in the construction and operation of the contact line above points and crossings of track, the impossibility of increasing by means of controlling apparatus the speed above a certain almost constant speed, which had to be accepted as the normal speed on load, also working at lower speeds being attended with considerable loss of power in the form of heat. That speed depends on the fixed periodic cycles of any kind of alternating current and the unalterable number of poles of the motors. The motor runs almost as if it was positively geared to the machines in the power station, and these features of three-phase motors of the times can properly be called the one-speed feature and the gear-wheel feature. Consequently the speed of a train remains practically constant on all up-grades as long as the electric current is on, and the torque of the traction motors corresponding to the resistance of the whole train keeps within certain limits, beyond which the motors get "out of step" and stop. This feature has, however, not been felt as a source of trouble, and will not be so felt if motor equipments and train loads are properly proportioned.

The B.T.B. was electrically equipped from the beginning; it is worked by the Emmentalbahn Co. operating a steam line of their own of 43 km. between Solothurn and Langnau. About 7 km. of track east of Burgdorf are common to both railways, and are therefore operated by steam and electricity at the same time.

Passenger trains of 90 tons weight are operated with motor-cars of the following type and equipment:—

with two different ratios of gearing, the one or the other gearing being clutched in, giving two speeds, 36 and 18 km. an hour, while the one-speed feature is reserved for each of these two particular speeds.

In 1910 another locomotive, of a type first introduced in the Simplon tunnel was added, which allows much heavier trains to be hauled. Instead of purely mechanical means of overcoming the one-speed inconvenience, not desirable in heavier traction, purely electrical means were adopted. The multi-speed feature, adopted and developed for other purposes than traction proper many years before, was resorted to and adapted to specially suit the case. By means of a controller-switch, sectionising the windings of the motors, four different numbers of poles are obtained.

Consequently the motors run, according to the number of their poles, by virtue of the position of the switching controller, at one of four particular speeds. It is seen that there are, so to speak, four different motors incorporated in one motor, properly called a multi-speed motor. With reference to each of these four speeds, the one-speed and the gear-wheel features obtain, but there is, as experience seems to prove, a sufficient freedom of adjustment to the varying requirements of practical driving on the railways having such locomotives (B.T.B. and Simplon).

The two types of locomotive of the B.T.B. are of the following description :—

	Type 1899.	*Type* 1910.
Number of axles, all driving	2	two 4-wheel bogies.
Total weight equipped	30 tons	42 tons.
Weight of electric equipment	10 ,,	18 ,,
Weight on single wheels	7·5 ,,	5·0-5·5 tons.
Diameter of driving wheels	1·230 m.	1·230 m.
System of motors	Three-phase one speed, rheostatic control, slide rings and brushes.	Induction multi-speed, intermediate voltage control, no slide rings nor brushes.
Voltage of motor	750	750
Periodicity of alternate current	40	40
Power of each motor, one hour rating	150 H.P.	400 H.P.
Number of motors	2	2
Mechanical arrangement	Gears (changeable) countershaft connecting rods	Gears, countershafts, connecting rods.
Gear ratio	1 : 1, 88 and 1 : 3, 72	1 : 4
Contact	Two-part bow	Two-part bow, articulated.
Brakes	Compressed air	Compressed air.
Normal (economical, constant) speeds in km. per hour	18 36	15·75 21·0 31·5 42·0
Total power of locomotive in horse-power	300 300	500 600 700 800
Total pull on head, kg.	4,400 2,200	8,570 7,720 6,000 5,140

The mechanical part of the locomotives is by Winterthur, the electrical by Brown, Boveri.

Electric traction on the B.T.B. has been satisfactory. Disturbances interfering with traffic have practically disappeared, and at no time has any dissatisfaction been noticed.

TABLE I.—DISTRIBUTION OF ELECTRIC RAILWAYS OF SWITZERLAND.

December 31st, 1909. Types and names of railways.	KM. of railway operated by electricity.	Electric railways in per cent. of all railways.
Normal Gauge.		
Federal Railways, including St. Gotthard, excluding Brünig	21·7	0·8
Arth-Goldau	2·6	—
Burgdorf-Thun	40·2	—
Frieburg-Murtens-Ins	32·3	—
Orbe-Chavornay	3·9	—
Normal-gauge railways excluding Fed. Rly.	79·0	11·7
All normal-gauge railways	100·7	2·9
Narrow-Gauge Railways.		
Aigle-Leysin	6·8	—
Bex Villars-Chésière	13·8	—
Grütschalp-Mürren	4·3	—
Martigny-Châtelard	20·5	—
Sissach-Gelterkinden	3·1	—
Stansstad-Engelberg	22·5	—
Other electric narrow-gauge railways	464·1	—
All narrow-gauge railways (steam and electric)	535·1	49·8
All normal and narrow gauge railways	635·8	14·2
Rack Railways.		
Brunnen-Morschach	2·0	—
Gornergrat-Bahn	9·3	—
Jungfrau-Bahn	5·6	—
Montreux-Glion	2·7	—
Wengernalp-Bahn	(18·0)	—
Other electric rack-railways	9·1	—
All rack-railways (steam and electric)	28·7 (46·7)	30·0 (48·6)
All tramways	388·7	99·5
All rope-railways	22·3	69

TABLE II.—CHARACTER AND COST OF CONSTRUCTION OF RAILWAY, ROLLING STOCK, TRAFFIC AND OPERATION.

Year 1909.	1 Orbe-Chavornay.	2 Stansstad-Engelberg.	3 Burgdorf-Thun.	4 Freiburg Murten-Ins.	5 Gruyère ch. d. f. el.	6 Montreux-Oberland bernois.	7 Martigny-Châtelard.	8 Simplon Tunnel.	9 Seebach-Wettingen.
Gauge, in metres	1·435	1·000	1·435	1·435	1·000	1·000	1·000	1·435	1·435
Length, in kilometres	4·0	22·5 (rack 1·5)	33·2 constructed 40·2 operated electr.	25·1 constructed 32·3 operated electr.	44·3	62·1	20·6 (rack 2·48)	21·7 (tunnel 19·803)	19·4
Grade maximum, per cent.	25	25 (rack 2·50)	25	30	30	67	70 (rack 200)	10	12
Lowest point, metres a. s. l.	450	438	535	435	672	398	470	630	391
Highest point, metres a. s. l.	473	1,002	770	632	861	1,272	1,227	705	459
Weight of rail in kilogrammes per metre	20·6	20·0	36·1	36·0	24·5	24·3	25·2-30·5	49·0	36
Number of electric locomotives	—	4 (rack)	2 (1911 : 3)	—	—	—	—	4	3
Number of motor-cars	4	10	6	4	13	24	12	—	—
Number of ordinary cars	4	26	17	55	104	145	29	—	—
Average number of trains over whole line	29·15	22·16	20·79	15·65	19·40	16·44	10·11	passenger 11 freight 5	16
Trains, kilometres run, 1,000	43	186	311	189	312	378	78	146*	
Passengers carried, 1,000	105	290	656	277	365	443	231		
Tons of all kinds of freight, 1,000	46	13	108	77	51	41	3		
Thousand francs per kilometre :—									
Cost of purchase of land	11	18	24	12	20	28	27		
Cost of electric line equipment	9	12	21	14	13	16	23		
Cost of buildings and station machinery	5	26	15	18	36	43	29		
Cost of construction complete	96	106	133	99	136	221	292		
Cost of rolling stock, locomotive and other	24	23	20	15	130	34	65		
Cost of railway complete	125	133	162	122	179	272	418		
Total amount	505	3,007	5,554	3,291	7,903	16,894	8,664		
Total operating expenses	48	223	420	243	333	519	207		
Total receipts from traffic	71	401	564	298	406	1,236	542		

Section of the Federal Railways. No individual figures available.

Experiments in 1906 and 1907. Regular operation from December 1st, 1907, until May, 1909.

* From June 1st, 1908, until May 31st, 1909 ; 22,933,000 ton-kilometres without, and 32,458,000 with locomotive weight.

TABLE II.—*Continued.*

Year 1909.	10 Locarno-Bignasco.	11 Bellinzona-Mesocco.	12 Seethal.	13 Martigny-Orsières. 1910.	14 Bernina.	15 Lötschberg. Spiez-Frutigen.	15 Lötschberg. Frutigen-Brig. (Building.)	16 Engadin (Rhätische Bahn). (Building.)	17 For comparison. St. Gotthard 1908.	17 For comparison. Federal Railways † 1909.
Gauge in metres	1·000	1·000	1·435	1·435	1·000	1·435	1·435	1·000	1·435	1·435
Length in kilometres	27·3	31·5	54·2	19·2	60·6	13·4	60·1	62·33	272·5 constructed 275·2 operated.	2,626 constructed 2,672 operated.
Grade maximum, per cent. ...	33	60	37	35	70	15·5	27	25·0	25-27	26
Lowest point, metres a. s. l. ...	217	231	357	469	429	631	681	1,290	205	277
Highest point, metres, a. s. l. ...	441	769	651	904	2,256	781	1,244	1,880	1,153	1,010
Weight of rail in kilogrammes per metre	20·7	25·0	—	36·0	—	36·0-42·0		23·5-27·0	36-51	25·0-51·0
Number of electric locomotives...	—	—	14 (steam) 25·0-36·0 before electrification		—	(1911) 2		11	169	1,178 steam 4 electric
Number of motor-cars	3	6	(1911) 10		15	(1911) 3		—	—	1 steam
Number of ordinary cars... ...	18	26	108		59	33		—	2,100	17,805
Average number of trains over whole line	13·74	12·86	18·88 (24 after electrification)		—	13 (1911 24 approx.)		20 (upper section 30)	43·63	33·47‡
Trains, kilometres run, 1,000 ...	140	150	379		—	71			1,449	31,547‡
Passengers carrried, 1,000 ...	188	229	786		274	211			1,051	76,285‡
Tons of all kinds of freight, 1,000	13	9	132		12	47			472	12,108‡
Thousand francs per km.										
Cost of purchase of land... ...	6	6	14			28			57	48‡
Cost of electric line equipment ...	10	11	—			—			—	(400 approx. Simplon Tunnel)
Cost of buildings and station machinery	9	15	16			19			78	45‡
Cost of construction complete ...	77	77	105			232			810	316‡
Cost of rolling stock, locomotive and other	9	15	23			26			95	66‡
Cost of railway complete ...	94	99	136			273			1,083	426‡
Total amount	2,573	3,125	7,365			3,664			296,823	1,023,089‡
Total operating expenses... ...	96	103	644			150			5,124	99,757‡
Total receipts from traffic ...	136	143	732		8·48688	254			8,510	158,745‡

Statistical figures not on hand. Figures not on hand. In course of construction. In course of construction. before electrification. before electrification.

† Excluding Brunig but including St Gotthard.

‡ Excluding St. Gotthard and Brunig.

A great benefit to electrical operation, especially since a powerful locomotive has been added, is that power is supplied from a large power-station near Spiez on the Lake of Thun, capable of dealing with the heavy variations in load. The power station belongs to a large power transmission and distribution enterprise, the Bernische Kraftwerke A.G., who operate about 60,000 H.P., and are controlling a large additional power in course of development. All power is hydraulic.

The tranmission voltage between Spiez and the 14 transformer sub-stations along the B.T.B. Railway is 16,000.

The consumption of electrical energy is 68 watt-hours per ton-kilometre. The cost of energy at 4 centimes the kilowatt-hour in 1904 was 0·284 centime per ton-kilometre and 18·35 centimes per train-kilometre. In the same year 290,807 train-kilometres were run. Lubrication amounted to 0·94 centime per train-kilometre.

Freiburg-Murten-Ins (F.M.A.) Railway.—This is interesting as the first normal-gauge railway which has undergone actual electrification. This railway is of invaluable service to the district traversed, but the financial results are unsatisfactory. The electrification was made possible by the controlling influence and financial interest of the State of Fribourg both in the F.M.A. (Fribourg-Morat-Anet) and in the electric power supply enterprise next door. The electrification was completed in 1902 as far as Murten, in 1903 on the extension to Ins only then constructed. The whole electric equipment of the railway was supplied by the Oerlikon Co. There are only four motor-cars. Locomotives will be used if the freight traffic becomes sufficiently developed.

This electrification was the first, and is the only normal-gauge one in Switzerland carried out on the continuous-current system with a third rail. The pressure of 800 volts was a novelty in third-rail practice at that time, and has proved safe and satisfactory.

Three-phase current of 8,600 volts pressure and 50 cycles is supplied from Hautersive, about 3 km. south of Fribourg, a power station of 6,000-10,000 H.P. The third rail is fed from two converter stations, each equipped with converting machinery of relatively moderate size and accumulator batteries to provide for peak loads.

The consumption of power is about 34 watt-hours per ton-kilometre, exclusive of losses in converting machinery and batteries. Inclusive of these losses the consumption is estimated at 60-80 watt-hours according to circumstances.

The F.M.A. is the only railway on which a comparison of steam and electric operation is available. The result of electrification has been satisfactory, as far as could be expected with the hitherto small traffic.

The following figures cover the years from immediately before to immediately after the electrification. The increase in capital is caused both by the construction of the Murten-Ins extension (about 10 km.) and the electrification of the whole line of over 32 km.:—

	1901.	1902.	1903.	1904.
	Francs.	*Francs.*	*Francs.*	*Francs.*
Capital investment ...	1,715,658	2,292,174	2,692,952	2,895,676
Excess of operating expenses	34,254	29,904	—	—
Excess of receipts from traffic	—	—	13,025	35,548
Interest on capital investment	—	—	0·485 %	1·23 %

The electrical system requires no detailed description; it is sufficiently known from the large number of third-rail elevated, underground, tube and other railways in other countries.

The motor-cars (cars by Neuhausen and Rastatt, electric equipments by Oerlikon) are of the following description:—

Total weight, equipped	33-42 tons.
Weight of electric equipment	12 tons.
Number of motors in car...	4
System of motors	Continuous current. Series-parallel and rheostatic control.
Voltage of motors	400
Power of one motor, one hour rating ...	110 H.P.
Mechanical arrangement	Single reduction, usual spring suspension.
Ratio of gearing	1 to 4.
Total normal pull on tread	5,000 kg.
Normal speed	21 km. per hour.
Maximum speed	54 „ „
Contact	Third rail top contact shoe.
Weight of trains (with one motor-car)...	80 tons.
Maximum acceleration	0·15-0·20 metre per second per second.

(*To be continued.*)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SOUTH AFRICA.—The South African Customs Authorities have issued a decision to the effect that electrophones (Stolz), being a device for making the deaf hear, are to be dutiable at the rate of 15 per cent. *ad valorem*, but if of British origin at the rate of 12 per cent. *ad valorem*. Illumination devices for gas or electric light are to be dutiable at the rate of 3 per cent. *ad valorem* if of foreign origin, and to be free of duty if of British origin.

CUBA.—The Cuban Government have recently issued a law modifying the provisions of the law relating to Consular fees. The new law provides that invoices for goods shipped to Cuba of a value of less than *five* pesos shall not require Consular certification. Invoices in respect of goods of a value of five pesos or more, but less than 50 pesos, shall be certified, the fee being 50 centavos.*

The other fees for the certification of invoices remain unchanged at the following rates:—

Invoices for goods to a value of 50 pesos up to 200 pesos	2 pesos.
Invoices for goods of a value exceeding 200 pesos —for each 100 pesos or fraction thereof in excess	10 centavos.

The Law prescribes further that the bills of lading (*conocimientos de carga*) of goods for shipment to the Republic shall be presented at the Cuban Consulates, to be viséed, at the same time as the invoices are presented for Consular certification. The fee for the Consular visa of each set of bills of lading is one peso.

* Hitherto, invoices covering amounts of less than 50 pesos have not required Consular certification.

SAMOA.—The Governor of Samoa has recently promulgated a law providing that, from April 1st, 1911, the import duty on the articles included under No. 9 of the Customs Tariff of Samoa (*i.e.*, all articles not specially mentioned in the Tariff), was to be increased from 10 per cent. to 12½ per cent. *ad valorem*.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,377. "Apparatus for electrically operating planing machines and the like reciprocating tools." F. Stott. July 31st.

17,381. "Control for trackless trolley vehicles and the like having auxiliary batteries for independent propulsion." W. A. Stevens. July 31st.

17,383. "Method of holding carbons in hand-feed arc lamps and the like." Mansell, Ltd., and M. Mansell. July 31st.

17,387. "Telephones, electrophones, electric lamps, electric radiators and the like." E. V. Cheese. July 31st. (Complete.)

17,390. "Magnetic improvement in boots and shoes." G. Clampitt. July 31st.

17,412. "Electric incandescent lamps." A. Bloch. (Convention date, August 27th, 1910, France.) July 31st. (Complete.)

17,419. "Automatic regulating mechanism applicable to electric generators." L. V. Grillet and J. B. Truchetet. July 31st. (Complete.)

17,425. "Electrical connections for secondary batteries and for other purposes." E. W. Part. July 31st.

17,426. "Secondary battery plates." E. W. Part. July 31st.

17,429. "Telephones." B. Gwozdz. (Addition to No. 11,234 of 1911. Convention date, April 20th, 1911, Germany.) July 31st. (Complete.)

17,430. "Visible electrical signals and safety backing devices in connection with colliery winding engines." T. Charlton and P. F. Smith. July 31st.

17,435. "Method of producing an insulating substance for the purpose of damping the sounding action of exposed electric conductors." W. Steinert. July 31st. (Complete.)

17,438. "Process for making electric condensers." The firm of Robert Bosch. (Convention date, October 3rd, 1910, Germany.) July 31st. (Complete.)

17,441. "Telephone cabinets." O. Sterkel. July 31st.

17,450. "Tramway and like rails." H. Grudgington. August 1st.

17,452. "Electrical influence machine for the stimulus of plant life, the production of X-rays and ozone, therapeutic and other medical work, and wireless telegraphy." T. Clark. August 1st.

17,463. "Spark plugs for use in internal combustion engines." G. C. Davis. August 1st. (Complete.)

17,479. "Electric heaters." W. G. Housekeeper. (Convention date, August 6th, 1910, United States.) August 1st. (Complete.)

17,480. "Processes of preparing filaments for incandescent lamps." W. G. Housekeeper. (Convention date, August 5th, 1910, United States.) August 1st. (Complete.)

17,481. "Electrical terminal devices." O. S. Schairer. (Convention date, August 6th, 1910, United States.) August 1st. (Complete.)

17,482. "Supports for incandescent lamp filament." A. S. Knight. (Convention date, August 6th, 1910, United States.) August 1st. (Complete.)

17,502. "Electric switches." H. J. Furneaux and W. B. Rock. August 1st.

17,518. "Electrical timing devices for races and the like." A. Griffiths and A. E. Comissiong. August 1st.

17,519. "Adjustable electric lamps." H. Fairbrother. (Vesta Accumulator Co., United States.) August 1st. (Complete.)

17,530. "Telephones." B. Gwozdz. (Addition to 11,234 of 1911; Convention date, April 21st, 1911, Germany.) August 1st. (Complete.)

17,550. "Life-saving belt for electricians." J. W. Brodie-Innes. (Ela, Archer, United States.) August 2nd.

17,567. "Electrically controlled clocks and the like." T. Burton. August 2nd.

17,587. "Thermic telephones." B. Gwozdz. (Addition to 11,234 of 1911; Convention date, April 22nd, 1911, Germany.) August 2nd. (Complete.)

17,593. "Electric terminals." E. G. Anness. August 2nd.

17,595. "Telephones." B. Gwozdz. (Addition to 11,234 of 1911; Convention date, April 22nd, 1911, Germany.) August 2nd. (Complete.)

17,597. "Treating substances by electro-osmosis." Felten & Guilleaume Carlswerk Akt.-Ges. (Convention date, August 2nd, 1910, Germany.) August 2nd. (Complete.)

17,605. "Electrolytic manufacture of metallic sodium and potassium and electrolyte for use therein." E. A. Ashcroft. August 2nd.

17,612. "Terminals for electric storage batteries or other purposes." C. Oldham. August 2nd. (Complete.)

17,629. "Dynamometers." Heenan & Froude, Ltd., and F. Harrison. August 2nd.

17,634. "Inductive wireless telephone and telegraphic installations." H. Von Kramer. August 3rd.

17,635. "Method for timing telephone calls." T. Doddrell. August 3rd.

17,653. "Spring points for tramways." R. W. Wilson. August 3rd.

17,654. "Tramway points." R. W. Wilson. August 3rd.

17,675. "Speed regulation of dynamo-electric machinery." H. Pieper. (Convention, date, August 6th, 1910, Germany.) August 3rd. (Complete.)

17,678. "Apparatus for the destruction of flies and other insects by electricity." A. C. Pemberton. August 3rd.

17,690. "Carbon electrodes." M. P. Schiff. August 3rd. (Complete.)

17,708. "Regulating devices for electric generators or motors." H. J. Balcombe and J. E. Calverley. August 3rd.

17,716. "Electric motors and dynamos." T. L. R. Cooper. August 3rd.

17,717. "Telegraphy." E. D. Cather. August 3rd.

17,718. "Time switches and the like." A. G. Zenner. August 3rd. (Complete.)

17,723. "Arc lamp electrodes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 3rd. (Complete.)

17,724. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 3rd.

17,761. "System of electrical cab signalling for railways or the like." O. S. Field. August 4th.

17,768. "Driving of rotary field induction motors." Siemens Schuckertwerke G.m.b.H. (Convention date, August 4th, 1910, Germany.) August 4th. (Complete.)

17,778. "Electric arc lamps." J. Wetter. (Ges. für Maschinen-und Metall-Industrie m.b.H., Germany.) August 4th.

17,780. "Method and apparatus for shaping filaments for electric incandescent lamps and the like." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.) August 4th.

17,784. "Device for reducing the electrical disturbances produced in electrical signalling circuits by the proximity of alternating currents." H. M. Edmunds. August 4th.

17,788. "Electric switches for use with timing or other predetermining mechanism." H. P. Allison and H. J. Arnold. August 4th.

17,791. "Means for regulating electric lamp circuits." H. Leitner. August 4th.

17,810. "Electrical heating apparatus particularly vulcanisers." W. H. Welch and H. Frost & Co., Ltd. August 4th.

17,820. "Telephones." B. Gwozdz. (Addition to 11,234, 1911. Convention date, April 22nd, 1911, Germany.) August 4th. (Complete.)

17,835. "Dynamo-electric machine." J. W. Greenwood. August 5th.

17,840. "Arc lamps." A. T. Dowdell. August 5th.

17,869. "Holders for electric lamps." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) August 5th. (Complete.)

17,874. "Registering device for telephone systems." Western Electric Co., Ltd. (Western Electric Co., United States.) August 5th.

17,875. "Telephone receivers." Western Electric Co., Ltd. (Western Electric Co., United States.) August 5th. (Complete.)

17,900. "Telephones." B. Gwozdz. (Addition to 11,234 of 1911. Convention date, April 22nd, 1911, Germany.) August 5th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Guide Sheaves for Ships' Telegraphs and the like. J. W. Ray. 28,330. December 6th.

Means for Controlling Electrically-Operated Driving Systems. Crompton and Co., Macfarlane, Burge and Williams. 29,727. December 21st.

Automatic Distributor for Electricity. H. Wolff. 29,810. December 22nd.

Tools or Machines Operated by a Reciprocating Element and means for Driving them Electrically. R. S. Crawford and J. Scott. 13,716. June 7th.

Electrical Ceiling Roses, Junction Boxes, Fuses and the like. H. L. Johnson and Loxley & Co. 14,042. June 10th.

Electric Clocks. F. Holden. 14,126. June 10th. (Patent of Addition not granted.)

Electric Safety Fuses. M. Kallmann. 16,258. July 7th.

Braking Induction Motors. A. Rosenberg and S. Peck. 17,010. July 20th.

Control Systems for Electric Motors. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 17,107. July 23rd.

Method of Manufacturing Spark Plugs. J. A. Anderson. 18,295. August 2nd.

Ignition Apparatus, more especially Intended for Use with Internal Combustion Engines. A. H. Smith and Muirhead & Co. 18,794. August 9th.

Electrical Heating Radiators. R. Cunnington. 21,848. September 14th.

Automatic Regulators for Electric Circuits. S. Presser & Ges. fur Elektrotechnische Industrie. 22,198. September 24th.

Rotating Commutators or Similar Structures. Vickers, Sons & Maxim, Ltd., and R. Williamson. 22,507. September 28th.

Electric Relay Apparatus. Westinghouse Brake Co. (J. O. Taylor.) 28,088. December 8th.

Electricity Motor Meters of the Mercury Type. Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz. 30,297. December 30th. (May 2nd, 1910.)

1911.

Relay for Undulatory Currents. E. Reisz and Strauss. 2,111. January 27th. (March 30th, 1910.)

Homopolar or Acyclic Dynamo-Electric Machines. O. Schuls and Eyermann. 2,369. January 30th.

Mounting of Electric Conductors more particularly Filaments for Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co.) 3,026. February 6th.

Electric Sparking Plug. Mazellier. 3,859. February 15th. (February 17th, 1910.)